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Economic Evaluation of Modern Irrigation Method in Wheat Production

(Case Study of Ardabil Province)

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Abstract:

Water is one of the vital human capital and other creatures of the world, which has no alternative, and is considered as the main driver of agricultural activity. In many countries, especially in arid and semi-arid regions, such as Iran, water is more important for the production and processing of agricultural crops. Unfortunately, despite the severe restrictions of water resources, the efficiency of using this very valuable input is low. Proper management of water consumption in farms and utilization units in the form of policies and executive programs is the most important step in optimizing the use of water resources and coping with dehydration and dehydration in different parts of the country. One of the measures taken to improve the efficiency and savings of agricultural water consumption is the development of using pressurized irrigation systems. The purpose of this study was to evaluate the economic impact of irrigation program on wheat crop in Ardebil province. For this purpose, the data of crop year 2015-2016 were completed by completing 340 questionnaires from two groups of farmers in the area(170 items of questionnaires from irrigated farmers and 170 other questionnaires from traditional irrigation farmers) and production function model used Is.The results of the study show that with the implementation of pressurized irrigation system, water consumption and production costs were saved and wheat production and water productivity levels increased by one percent significantly.

Keywords: Economic Evaluation - New Irrigation - Wheat - Ardabil Province

Introduction

Water is a unique commodity and a very vital material. Limitations of this vital substance affect the capacities of other vital resources including food, energy, fish and wildlife. The availability of other resources such as food, minerals and forest products can also be limited by the quantity and quality of water resources. In some of the poorest and richest countries in the world, water per capita is also decreasing due to environmental issues, rising costs and scarcity. The distribution of water flows worldwide is also unbalanced and does not fit with the population distribution. Due to the lack of precipitation in the country and the inappropriate temporal and spatial distribution of precipitation, as well as the consequent droughts of the last two decades, the necessity of converting and changing irrigation methods from traditional to modern, including sprinkler and drip irrigation, is a cost-effective goal. Attrition and reduction in water consumption are increasingly felt.

We live in a world where water scarcity is always a major concern, a scarcity that grows every year. Many people in developing countries are currently deprived of enough water to meet their basic needs. One of the most important signs of water scarcity is the drying up of rivers which is now observed in some of the most important rivers in the world. For this reason, people living at the bottom of the rivers face severe water shortages all or part of the year. One widespread concern is that the Earth is moving toward water scarcity. Since about 70 percent of all water harvesting is consumed in agriculture, there is concern that water scarcity in the world means a lack of agricultural water. Sixty percent of the world's fresh water is allocated to countries including Canada, China, Colombia, Peru, Brazil, Russia, the United States of America, Indonesia and India. In contrast, about five countries in the world are experiencing severe water shortages. Some of them have almost no access to freshwater. Access to adequate and adequate water has become a serious crisis in some countries, including Kuwait, Bahrain, Malta, the United Arab Emirates, Singapore, Jordan and Libya. According to UN studies(2012), more than 3 million people live in areas threatened by climate change and desertification, with 1.4 billion people deprived of access to safe water. Of the world's total water, 97.4 percent of it is saltwater from the seas and oceans, which is actually useless. As such, only 2.6% of its freshwater reserves form. Most of it is in the form of ice at Earth's poles and glaciers (1.98%) and groundwater (0.59%), which are unavailable. Globally, the average consumption of fresh water in the drinking and sanitation sector is 2 percent, industrial, recreational and commercial activities, and about 5 percent, and agriculture alone is 2 percent. In some countries, especially in African countries, up to 5% of freshwater resources are spent in agriculture in the desert and coast of Africa. In Iran, the share of agriculture in water consumption is 93% (Ministry of Energy, 2013).

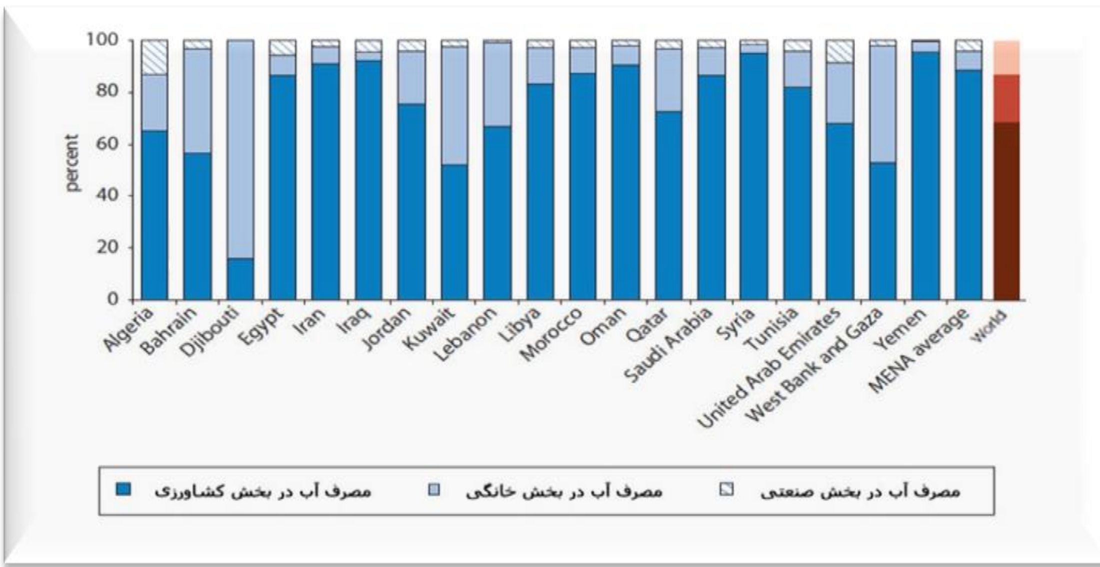
Iran is a mountainous land where two ranges of Alborz and Zagros are barriers to the north and west of the country, thus making up most of the country in arid and semi-arid regions. Iran's position in the global dry belt with an average annual rainfall of 250 mm (Meteorological Organization) in the long run, considers water as the most important limiting factor in agricultural production and is of economic importance. In irrigated agriculture, water is considered as a major factor in food security and economic cycle of the country (Tajrishi et al., 2004). One of the supportive policies of governments in the agricultural sector is to support the development of pressure irrigation to reduce water consumption and increase its productivity. The purpose of this study was to investigate the effect of pressurized irrigation on water consumption, reduce production costs and wheat production and water productivity in wheat production from farmers' perspective. Surveying the status of water consumption by major sectors shows that in most parts of the world (except for the Americas) agriculture has the largest share of water consumption. The share of water consumed in agriculture in the Middle East and Africa is 84% and 82%, respectively, in Iran at 93% (World Food Organization, 2011).

Table (1) Distribution of water consumption by consumption sectors in different regions of the world (percent)

area	agricultural	industry	Urban
Africa	82	5	13
United States	49	35	16
Asia	81	81	6
Europe	72	7	6
Oceania	60	15	26
Middle East	84	7	9
Iran	93	2	5
World	69	19	17

Source: World Food Organization – 2011

The chart below shows the percentage of fresh water consumption in the three sectors of agriculture, industry and urban (household) sectors in a number of countries.



Source: World Food Organization

Diagram (1) Water consumption in different parts of countries in the Middle East and North Africa compared to the global average

Among the countries in the world, water consumption in agriculture is highest and above the world average in Germany, Syria, Iraq, Oman, Egypt and Iran. Countries like Ethiopia, Kuwait, Bahrain have less than the global average of water use in agriculture.

One of the important indicators of water consumption is productivity index. This indicator shows that for a unit of water consumption (cubic meter) several units of GDP are obtained. In 2011, water productivity in the country was reported at $ 3 (2005 dollars) per gram of water consumed. That is far below the world average of water productivity ($ 8.3 per gram of water consumed). In low-income countries, the figure is $ 2.1, in middle-income countries $ 4.7, and in high-income countries, $ 39.1. In terms of water productivity index, Iran is on the verge of low income countries. This is basically an unfavorable situation (World Bank, 2014).

Table (2) Average water productivity index in economic sectors across countries (Unit: Gross Domestic Product (USD) per cubic meter of water)

Row	Name of country	Agriculture	Industry	Tota	Row	Name of country	Agriculture	Industry	Total
1	Uzbekistan	2/5	0/1	0/3	16	Argentina	0/6	21/6	3/3
2	Azerbaijan	0/1	0/6	0/4	17	Mexico	0/4	2/33	7/5
3	Kyrgyzstan	0/1	1/2	0/1	18	Japan	1/2	91/9	53/6
4	Iraq	-	1	0/5	19	France	8/8	4/9	3/34
5	America	0/5	9/6	20/9	20	India	0/2	3/5	0/8
6	Canada	2/5	7/1	16/4	21	Germany	2/3	15/9	40/9
7	Australia	0/6	41/2	17/4	22	Turkey	1	10/4	5/3
8	Syria	0/3	13/9	1	23	Russia	1/3	2	3/7
9	Sudan	0/1	11/2	0.4	24	China	0/4	2	2/2
10	Pakistan	0/2	4/7	0/5	25	Malaysia	1/5	24/2	10/5
11	Iran	0/3	26/2	1/6	26	South Africa	0/5	53	11/3
12	Egypt	0/6	0/8	1/6	27	Low-income countries	0/3	0/7	0/8
13	Armenia	0/9	21/6	8/3	28	Middle-income	0/6	19	3/3
14	Spain	1/3	24/9	17/3	29	countriesHigh-income countries	2/7	33/6	28/2
15	Italy	0/6	17/2	24/7	30	World average	1	18/7	8/6

Source: World Bank Report - 2012

The global average of water productivity in agriculture is equal to one and 18.7 units in industry. This figure for Iran is 0.3 and 26.2, respectively, which in the agricultural sector is lower than the world average and is equivalent to the water use efficiency in low-income countries. In developed countries due to the high share of industry and services in GDP and higher technologies in using water resources, water productivity index is higher and more value added than in less developed countries. In many countries in the region, including China, India, Yemen, Egypt, Syria, Pakistan and Australia, water is becoming scarce. And brings economic, social and political concerns. Therefore, water policy is the most important economic policy issue. In such countries, the economy is primarily based on agriculture and has been a strategy for agricultural production and self-sufficiency in food staples. Some countries'experiences with water development have been discussed. (World Food Organization, 1999).

Due to the importance of water resources, water supply and demand management practices as a new and appropriate approach in water resources management and utilization are necessary. Numerous studies have been done in this field such as: Ziba'i (1383), Borminejad (2007), Shajari (2007), Sabouhi (2007), Abdollahi (1386), Soltani (1372), Moghadasi (1275), Asadi (1375). Studies abroad, such as Satyasi (1997), Doppler (2002), Abramadi (2009), Shangoan (2002), Roger (2002), have also studied various water resources issues in the field. Ways to control and optimize groundwater utilization, water utilization management, water resource pricing policy, optimal consumption and conservation and sustainability model, etc. have been discussed.

Mohseni et al (2009), in a study of the effects of canola cultivation on the level of Namdan Plain fields have been studied. Sample farms. Mohammadi (2012), in a study entitled The Effects of Trade Liberalization on the Welfare of Consumers and Producers of Agricultural Products, Virtual Water Exchange and Resource Stability in Fars Province, Using Positive Mathematical Planning, has shown that the implementation of free policy Commercialization of virtual water trading will be differentiated by different products. According to the results of Absalan et al. (2007), wheat water productivity from 0.24 to 1.2 kg / m3 was relatively desirable for areas with saline water and soil. Montazero Kosari (2007) reported the productivity of rice, maize, cotton, alfalfa and potato water in the country were 0.42, 1.17, 0.6, 0.89 and 2.74 kg / m3, respectively. And. According to the results of the Heidari study (2014), the potential and current water productivity indices in Karkheh watershed are 2.55 and 0.82 kg / m3, respectively. However, in Turkey the average range of corn water productivity variations between 1.65 and 2.5 kg / m3 have been reported (Doug Delan et al., 2005). In this country, the average water productivity is 1.2 kg / m3 (Borac, 2005). The results show that improvement of soil and water management practices in recent years has increased water productivity, so that by applying new irrigation methods such as sprinkler and drip irrigation, due to improved field irrigation management, interest Water content has increased significantly (Dehghani et al., 2006).

Spliman et al(2008), also using data envelopment analysis, analyzed the water use efficiency in South African farms and their effective factors. The results showed that the mean of water efficiency under constant and variable efficiency in terms of efficiency were 43% and 67%, respectively, and factors such as irrigation method, land ownership, land size and crop selection were effective on irrigation water efficiency. Ylmaz et al.

(2009), using data envelopment analysis method, investigated the water use efficiency of the Mendras Basin in Turkey. Farijad et al (2009) have investigated water use efficiency in greenhouses in Tunisia and the factors affecting it using data envelopment analysis method. Percentage.

Jalalian (2012), in a study entitled: Analyzing the Impacts of Modern Irrigation Systems on the Status of Agricultural Users in Khodabandeh, has concluded that the implementation of the new irrigation plan has had economic, social and environmental effects on the agricultural status of the region. Based on the performance test per unit area as well as the employment after the implementation of the plan shows a significant difference with the pre-implementation and has an increasing trend. Ezzati et al. (2014), in studying barriers and problems of wheat farmers in applying pressure irrigation technology from the viewpoint of members of agricultural production cooperatives in Ardebil and Bila Savar, showed that between wheat production per hectare before and after There was a significant difference at 1% level of pressure irrigation system and annual net income per hectare before and after the system. Also, based on the results of the factor analysis of the challenges of applying pressure irrigation technology from the perspective of the farmers studied, these challenges were categorized into four groups (technical, social, natural and economic factors). These four factors accounted for 64.21% of the total variance.

Karimi et al. (2014), in the technical and economic evaluation of drip irrigation and furrow irrigation methods in cotton under deficit irrigation, concluded that yield of 8% and water use efficiency of 48% in drip irrigation system. E is higher than furrow irrigation and water consumption has decreased by 40%. A study conducted by Gharabagh et al. (2014) in Urmia region showed that the economic value of water per cubic meter of wheat production is 726 Rials, while farmers only 17% (125 Rials per cubic meter). And farmers have no incentive to conserve water.

Research Method

Among the strategic crop of the agricultural sector is wheat production, which produces a total of 712 million tonnes worldwide, which makes up 28% of the world's grain. The major wheat producing countries are China with 132 million tonnes; India with 93.5%; Russia with 73%; US with 63%; Canada with 30%; France with 29.5%; Ukraine with 26.5%; Pakistan with 26%; Germany with 25% Australia ranks 13th with 23 and Iran with 7 million hectares (2.5 million hectares of water and 4.5 million hectares of dryland) and 15 million tons of production (UN Food and Nutrition 2011). Ardebil province is the fourth country with 35,000 hectares under cultivation and 740,000 tons of wheat (Ardabil Province Agricultural Organization, 1396).

In socioeconomic studies, both mathematical and programmatic methods are commonly used to achieve research goals. For this reason, production function methodologies have been used. They are purposeful, practical, and in terms of pesticide production, and they are very powerful. The following are some of the methods (questionnaires) for targeting diabetes. The required statistics, which include farmers in Ardebil province, have been implemented in some agricultural areas, irrigation and labor have not been implemented in other areas.

Different methods are used to determine sample size in research. There are two common ways to do this. One is the use of the Charles Cochran formula and the other is the Morgan table. Using Cochran formula is the simplest method to determine sample size. For the present study, 170 samples from the group of farmers under pressure irrigation (1750), and from the group of farmers with traditional irrigation were selected as the sample. A total of 340 questionnaires were filled out from the two groups of farmers and their data were analyzed after extraction. The variables that have been studied and defined are:

- Acreage
- Number of domestic workers
- Amount of seed, fertilizer and toxin consumed
- Income-to-cost ratio
- History of agricultural activity
- Farmer literacy and awareness
- The second job of a farmer
- Farmer's residence
- Costs before implementing the new irrigation plan
- Providing farmers with training and extension programs

The production function was used to analyze the study data. A production function is a regular way of showing the relationship between different amounts of an input or resource used to produce a product (output) or performance related to that product. In other words, the production function is a technical relation between the factors of production (inputs) and the product. Based on this relationship and with existing technology, inputs are combined and eventually the product is produced. According to production theories, a given quantity of production is a function of the consumption of different inputs. If Y denotes the amount of output, we will have: (1) Y = f (,) where f is a functional relation, X is a vector of variable inputs, and a vector of fixed or quasi-stationary inputs (Musa Nejad Vanjarzadeh, 1997). In other words, the production function explains the physical relationship between the amount of production and the amount of inputs consumed. There are over 30 models to estimate the production function. Since the trans-log production function model has the most application in agricultural research by researchers, compared to other production function models, it is the selective production function in this study. This production function model was developed by Christensen et al. In 1973. In this type of function, the power of one, the power of two, and the interactions of the independent variables are considered. The form of the translog production function with n variable inputs is as follows:

$$logy=log\alpha + \sum_{i=1}^{n}\beta_i logx_i + \sum_{i=1}^{n}\gamma_i(logx_i)^2 + \sum_{i=1}^{n}\sum_{j=1}^{n}\delta_{ij} logx_i logx_j + u_i \quad (٢)$$

In this function y denotes the output value and xi, the inputs, and ui including the random error. This function is($\beta_i + \gamma_{ij} = 0$) transformed into the Cobb-Douglas production function if it is (Akbari Vernani, 1996). After calculating the final productivity, one can calculate the final productivity value under the following relation. (3) VMPXi = MPxi * PY Given that the market for agricultural products is somewhat competitive in terms of price, so if the value of the final productivity is equal to its price, then the value of the institutions' consumption is optimal. (4) VMPXi=PXi $\Rightarrow \frac{VMPx_i}{Px_i}=1$ The ratio is used to determine the efficient use of the production factors. If it is equal to 1, it shows that the input i, is used optimally, and the amount of consumption should remain at this level.

research findings

The number of households reflects the household dimension in rural areas, which is important in terms of providing the labor force needed for agricultural and livestock activities. The household dimension can be economically influential in generating income and providing a part of production costs as well as family costs. About 50% of the population under study has between 4-5 persons. 38% have less than 3 people, only 12% have more than 6 people. The average number of farmers under study was 3.83 persons, which is lower than the average household size in rural areas according to the statistics of Iran Statistics Center (5.23). In terms of age status of the beneficiaries; 40 to 59 (57%). And 28 percent of farmers are over 60 years old.

Table (5) Age status of the studied farmers (%)

Group of farmers/ Age group	Farmers with traditional irrigation	Farmers with modern irrigation	average
Less than 39 years	17	14	15
Between 40-59 years	53	60	57
Age over 60 years	30	26	28
averag	43/52	16/54	29/53

Reference: Research Findings

Also, 15% of farmers are less than 39 years old. The average age of farmers in the region was 53.29 years. This figure is 50 years for the average age of farmers in the country. In terms of literacy level, in the study population, 17% of farmers were illiterate, 33% had primary literacy and literacy, 16% had guidance literacy, 16% had a diploma, 5% had a high school diploma, 10% had a bachelor's degree. And 1 percent have master's degrees. In other words, only 32% of the studied population have high school diploma or higher. According to statistics available in the country, the illiteracy rate in rural communities is over 20%, which is estimated at 17% for the study population. Farmer irrigation had more pressurized irrigation services and programs under pressure and planting principles, and crop yields were higher than traditional irrigation farmers. The following table shows that 73% of farmers have specialized irrigation training and extension services.

Table (6) Percentage of farmers with modern irrigation training and extension services (%)

Group of farmers / Options	Percentage
Attend training and promotion classes	73
Radio and television program	55
Promotional Magazine and Posters	91
Expert consulting services	68
average	71.8

Reference: Research Findings

The experience of the farmer indicates his knowledge, experience and level of information in the field of agriculture. This knowledge can include: practical experience, native knowledge, and agricultural science knowledge. Farmer's track record can have a positive impact on planning, execution of plans and projects, and many local and regional decisions.

Table (7) History of farming activity (%)

group	Less than 19 years old	Average of 20-39	years Older than 40 years old	average
Activity History (Year)	24	42	33	56/30

Reference: Research Findings

In Table (7) the average agricultural activity history of the studied community is approximately 30.5 years. Overall, about 42 percent of farmers are between 20 and 39 years old, 33 percent are over 40 years old, and 24 percent are less than 19 years old.In terms of agricultural economics, the size of land parcels and their number are effective in reducing costs and increasing production and income. As one of the first important measures to be taken in implementing the modern irrigation system is the accumulation of arable land. One of the major problems in the economic path of economic production and realization of sustainable agriculture in the system of micro-agricultural exploitation is the multiplicity of agricultural lands and their small size. Iranian agriculture is predominantly smallholder, and over time, the size of agricultural land becomes smaller and smaller due to the implementation of inheritance law. So that in some cases the size of agricultural land has become so small that it is uneconomic to farm. The amount of per capita cultivation in agricultural land is usually less than 2 hectares. About 86.7% of the country's agricultural units are under 2 hectares. Of these, 34.6% were under 1 hectare, 15.4%, more than 1 to 1 hectare, 22.9%, 1 to 2 hectare and 14.1% were more than 1 to 2 hectare. (General Census of Agriculture, 2006).

Table (8) Number of plots of land and average size of plots

Number of agricultural land parcels of farmers						
Number of agricultural land parcels of farmers	Less than 5 pieces	Between 6-10	Between 11-15	Between 16-20	More than 21	averag e
Percentage	27	42/5	15/5	8/5	6/5	8/3
Average size of farmers' plots (ha)						
Size of parts	Less than 2		Between 2/1 to 5	Between 5/1 to 8	More than 8/1 hectare	averag e
Percentage	17		46/5	24/5	7	1/73

Reference: Research Findings

In the above table, the average number of plots of farmers is 8.3 plots, with 27% of farmers having less than 5 plots, 42.5% more than 5 plots and less than 10 plots, 15.5% more than 11 plots. And less than 15 plots and 15% more than 15 plots. The average size of each plot of land in the study area was estimated to be 1.73 ha. 17% of farmers had less than two hectares, 46.5% more than two and less than five hectares, 24.5% of farmers had more than 5 hectares and less than 8 hectares. The percentage is more than 8 hectares. Among the goals of implementing the new irrigation system at the farm level is to improve and improve the economic indicators of water consumption and produce more agricultural products. It is expected that with the implementation of the new irrigation system, the water consumption of agricultural water will be reduced to the threshold of water requirement of the crop. Secondly, production costs have a decreasing trend compared to pre-irrigation. Thirdly, due to a series of scientific and technical principles, the increase in crop yield was due to adherence to the crop, and an increase in crop yield was observed. Therefore, with the implementation of the pressurized irrigation system, economic production indices are expected to improve and improve productivity levels.

Comparison of the two irrigation methods shows that using the new irrigation method will save 15% on water consumption. Of the total water requirement of wheat in the study area, about 25% of it is provided by rainfall as effective rainfall. The remaining 75% is provided through irrigation during the growing season or the crop year. So that the water requirement of wheat is 4710 cubic meters per hectare. The irrigation water available in the study area for the mentioned plant is 2720 cubic meters per hectare. However, the amount of water consumed in both irrigation methods (traditional and modern) is more than required. As the table below shows, under pressure irrigation, 36% and in traditional irrigation, 61%, more than water supply can be obtained through irrigation, respectively. This figure is higher for potato than for other crops.

Table (9) Amount of water consumed and comparison with water requirement (ha-m3)

Component /Need and supply of water	Cubic meters
Total water requirement	4710
Rainable water	1990
Water supply through irrigation	2720
The volume of water used in traditional irrigation	4380
The ratio of water used by the traditional method to the water supplied by the plant through irrigation	1/61
The volume of water consumption in the modern irrigation method	3690
Ratio of water used by the new method to irrigation	1/36
The ratio of water used in the modern to traditional method	0/84
Water saving (by applying new method (%)	16

Reference: Research Findings

Table (9) shows a comparison of the amount of water consumed in the two irrigation methods, although under pressure irrigation, about 16% less than traditional irrigation, wheat water use was consumed, but in both methods (traditional irrigation). And under pressure), the amount of water consumed by the wheat exceeds the amount of water that would have to be supplied by irrigation. The table below shows the status of production costs and the share of water and irrigation costs of total production costs in the two production methods (modern and traditional irrigation methods). The results show that the ratio of total cost of production per hectare with modern irrigation to total cost of production with traditional irrigation is estimated to be 1.07 for wheat. And the cost of water in production with modern irrigation is also higher than the cost of production in traditional irrigation (1.12).

Table (10) Comparison of Production Costs in Two Irrigation Methods (Million Rials per Hectare)

Cost/Irrigation method	Traditional irrigation method	Modern irrigation method	Modern to traditional ratio
Total cost	17/6	19	1/07
Cost of water	2/8	3/2	1/12
Share of water cost of total cost	15	16	1.07

Reference: Research Findings

The reason that the cost of water has been estimated higher than the cost of production with the modern irrigation method is that firstly, the implementation of the new irrigation method requires irrigation equipment that has a depreciation cost (with a useful life of 20 years) of the total water and irrigation costs. Is. Also ،the level and level of mechanization application in the modern irrigation method has increased which leads to higher irrigation costs in the new irrigation method. Secondly, according to the Price

Law of Water, up to 3% of crop value in modern irrigation system and 1% of traditional value in traditional irrigation system is received from farmers as price water, which increases the cost of water production by modern irrigation method. According to the law on the price of water, as the amount of crop production increases per hectare, the cost of water will increase, and the cost of agricultural water will increase. On the other hand, other water costs (including labor cost) in the modern irrigation method have been reduced.

According to the Ministry of Agriculture Jihad, the average wheat production in the province for wheat production is 2788.6 kg /ha. Table 11 shows that in the study population, this figure was 2698 for farmers with traditional irrigation and 3850 kg / ha for farmers with modern irrigation, respectively. In other words, production efficiency in modern irrigation method is about 1.63 times that of traditional irrigation method.

Table (11) Comparison of wheat production in two irrigation methods (kg)

Title/Irrigation method	Traditional irrigation method	Modern irrigation method	Modern to traditional ratio
Wheat produced per hectare	2698	3850	1/42
Production per cubic meter of water	0/62	1/04	1/70

Reference: Research Findings

In the table above, the average wheat production in traditional irrigation is very close to the average production in the province. And in modern irrigation production method, the production rate is 1.42 compared to traditional irrigation production. Wheat production per cubic meter of water in traditional irrigation method was 0.62. In the modern irrigation method, it was estimated to be 1.04 kg, which is 1.70. Comparison of income status between two groups of the study population shows that there is a significant and significant difference. As the table below shows, the difference in the ratio of income to cost between the two groups of farmers (modern and traditional irrigation) is more than 80% .

Table (12) Comparison of Income and Cost of Wheat Production in Two Irrigation Methods (Million Rials per Hectare)

Irrigation method/the unit	Income		cost		The ratio of income to cost	
million rials	Traditional	Modern	Traditional	Modern	Traditional	Modern
	37	49	17/6	9	2/58	2/1

Reference: Research Findings

Also, the above table estimates the profit of wheat production by modern irrigation method, 49 million Rials, and by traditional irrigation, 37 million Rials per hectare. In other words, the rate of profit in wheat production by modern irrigation method is estimated to be 1.76 times higher than that of traditional irrigation. Not all changes in increasing revenue and profits, as well as the reduction of production costs in the modern irrigation method, are necessarily the direct result of the change in irrigation method. Rather, it relates to the direct effect of changing the irrigation method, and partly to the indirect effect of change through the amount and manner of consumption of other inputs used in the production process. In order to study the direct and indirect impact of the modern irrigation method on production, the production function is used. In this function, the irrigation method is applied as a virtual variable across the origin and coefficients of other independent variables of the function; and the results are analyzed and analyzed.

Table (13) Independent Function Variables

variable	description	variable	description
X_1	Areaunder cultivation (ha)	**X_6**	Amount of used cars (hours)
X_2	Volume of water consumed (m3)	**X_7**	Farmer's Activity (Virtual)
X_3	Amount of seed consumed (kg)	**X_8**	Farmer Training (Virtual)
X_4	Amount of fertilizer (kg)	**X_9**	Farmer Literacy (Virtual)
X_5	The amount of toxin consumed (kg)	**X_{10}**	Recruitment Force (day person)
X_{11}	Irrigation method (using modern irrigation method d = 1 and traditional irrigation method = d = 0)		

Reference: Research Findings

With the implementation of the new irrigation system, it is expected that there will be changes in the amount of inputs used in production, including water input, manpower, fertilizer, seeds, machinery, poison and other inputs. This will cause a change in the production of the product. Because of the trans-log production function ‹more flexibility and also due to the interaction of inputs were preferred ‹to use the trans-log production function model to estimate the relationship between factors and inputs with production. According to the following table in the translog production function estimated, with respect to the value (R^2), 0.84% of the dependent variable (production rate) is explained by the independent variables and with respect to the F value and its significance at the 1% level, Confirmation is the estimated output function of the translog. According to the following table in the translog production function estimated, with respect to the value (R^2), 0.84% of the dependent variable (production rate) is explained by the independent variables and with respect to the F value and its significance at the 1% level, Confirmation is the estimated production function of the translog. On the other hand, the estimated DW statistic, which is close to two (1.89), indicates that there is no correlation in the variables. Partial correlation coefficients have also been used to identify and identify correlations. If the correlation coefficients between the explanatory variables are small, it does not mean that there is no linearity and there may be a relatively high linearity in the model. To clarify the issue, partial correlation coefficients were used. The coefficients are less than $\sqrt{R^2}$ and the correlation between the explanatory variables is weak and negligible.

Cumulative stability test as well as normality test of disturbance components were used to evaluate the validity of the results. The results showed that none of the cumulative errors were out of bounds and this test showed no structural change. Give. To analyze the variance of variance, the white matter statistic was used. The results also show that, given the low value of R^2 and F in white, the estimated production function is estimated by R^2 and F, and significance of white F statistic, it was found that the difference between R^2 obtained in white And the estimated production function is significant and the H0 hypothesis (ie, variance constant) is confirmed and the estimated production function is more stable.

Table (14) Results of Estimation of Wheat Translog Production Function

Significance level	**T statistics**	**Criterion error**	**Coefficient**	**variable**
Width of origin	4/56	1/48	3/81	0/002
The volume of water consumed	-0/41	0/17	-1/73	0/013
Seed used	1/11	0/33	2/52	0/012
The amount of machinery used	0/42	0/21	2/02	0/036
The area under cultivation can be two	-0/44	0/23	-2	0/041
Interaction of crop area and water volume	0/18	0/076	2/40	0/016
Interaction between crop area and seed use	0/21	0/07	-2/41	0/015
Interaction of crop area and fertilizer use	0/12	0/08	1/7	0/082
Interaction between cultivated surface and used machinery	-0/05	0/01	-1/91	0/05
Interaction between training and the workforce of irrigation	0/92	0/51	1/79	0/07
Interaction between education and toxin consumption	0/21	0/1	1/73	0/075
The effect of virtual education variable on seed consumption	-0/71	0/32	-2/23	0/22

The Virtual Impact of Irrigation on Consumption Seed and Training	0/5	0/16	3/16	0/006
The Virtual Impact of Irrigation Method on Education	-0/22	0/11	-1/93	0/051
The virtual variable of the irrigation method	0/6	1/78	2/17	0/031
R-squared		0/84	Adjusted Rsquared	0/82
Sum squared resid		42/37	S.E. of regression	0/34
F-statistic		131/72	Durbin-Watson stat	1/89
Prob(F-statistic)			0/001	

Reference: Research Findings

In the above table, considering the significance of the coefficient of the virtual variable (which is the irrigation method), it is shown that the new irrigation method is effective in shifting the width from the production function source upwards. Also, the effect of training variable on production with modern irrigation method had a positive effect on slope of production curve (upward). Therefore, pressurized irrigation can be considered as an effective technology in improving the production process. Improvement of production process in order to change the composition and amount of inputs and outputs compared to the time before implementation of the new irrigation method in order to optimally use inputs. Of course, observing the correct principles of applying the inputs and using them in time to improve the production process will not be ineffective. In addition to reducing costs and increasing product production, it provides the basis for the sustainability and maintenance of basic production resources and inputs. The results also show that although the irrigation method has changed from traditional to modern and the amount of water consumed has decreased, still the volume of water consumed is more than the amount of water needed for the plant or crop. And the water input is used even more. As shown in previous calculations, the amount of water consumed in the modern irrigation method, although decreased compared to the traditional irrigation method, still in the modern irrigation method, the amount of water consumed is higher than the amount of water required by the plant. The obtained coefficients confirm this and it is necessary to reduce and reduce the amount of water consumed up to the threshold of required water volume through irrigation.

The above table shows that in agriculture with modern irrigation method, there is a direct relationship between the amount of seed consumed and the amount of crop production. Interaction between crop area and water volume - Interaction between crop area and fertilizer - Interaction effects of training and irrigation workforce - Interaction effects of training and amount of toxin have both direct and positive effects on crop production. Interaction between cultivation area and seed use - Interaction between cultivation area and machinery used and interaction effects of training on seed consumption have negative and negative relationship with crop yield. The concepts of average productivity (AP) and end productivity (MP) are used to calculate partial productivity and determine the economic status of input consumption. For the optimal case, the result is (**vmp/px**) equal to one. If this ratio is higher than one, it means that the input of production is used less than optimal. If this ratio is less than one, it would mean that the amount of inputs consumed in the production of the product is too optimistic. The following table calculates water input for both traditional and modern irrigation.

Table (15) Comparison of Water Productivity in Two (Modern-Traditional) Irrigation Methods for Wheat Production

Irrigation method	**y:** Production per hectare (kg)	Volume of water consumed per hectare (m3)	product Value (Thousand Rials)	**P:** Price of water unit (Rials)	AP	mp	Vmp (Rials)	Vmp/px
traditional	2698	4380	33725	1589	2/12	-0/4	-500	-0/31
Modern	3850	3690	48125	9176	3/1	0/11	1375	0/015

Reference: Research Findings

The above table shows that the ratio of the final value of production to the cost of input water (vmp / px) is less than one in traditional irrigation mode and less than one in new irrigation mode. This means that in both methods the amount of water used to produce the product exceeds the required amount. The amount of water consumed in production by traditional irrigation is higher than modern irrigation. Therefore, in both cases it is necessary to reduce the volume of water consumed.

One of the most important inputs that can be effective in the efficient use of other inputs in the agricultural production process is the input or management factor. The principle of management is in the management of human resources and in the proper use of productive inputs. How much input and at what point in time and with what principles and methods to use it. It is done by a human agent. Training and awareness of human resources and farmers can provide proper management of the production process. The estimation model has also shown that education can have a positive effect on increasing crop production by facilitating acceptance of new technology by farmers.

Conclusion

The results showed that the amount of water consumed in the modern irrigation method was 17% lower than the volume of water used in the traditional irrigation method. They have a significant percentage. However, the volume of water consumed in modern irrigation production is about 30% higher than that of water (wheat). In other words, modern irrigation can reduce water consumption by at least 20% . In other words, using a pressure irrigation method can save up to 37% on agricultural water consumption. If we consider the productivity of the amount of product produced per unit of input consumption, it is estimated that per cubic meter of water consumed in the irrigation method was 1.04 kg of wheat. Whereas in traditional irrigation method the amount of wheat produced was 0.62 kg/m3. Comparison of these two numbers shows that water productivity in modern irrigation method is more than 1.8 times more than water productivity in traditional irrigation method.

In general, the estimated production function shows that by applying the new irrigation method, as production technology, the width has been shifted upstream from the production function source and also the agriculture by pressure irrigation method improves inputs and proper utilization. It's time for them. As a result, the amount of crop grown in relation to the agricultural situation increased with traditional irrigation. In general, with the implementation of the modern irrigation system, both the volume of water consumed has been reduced, production costs have been reduced and wheat production has increased.

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