QUID Nº30, pp. 18-27, enero -junio de 2018, ISSN: 1692-343X, Medellín-Colombia

ENERGY USE AND SENSITIVITY ANALYSIS OF ENERGY WITH ECONOMICAL MODELS FOR RICE PRODUCTION IN IRAN SEMI-MECHANIZED SYSTEM

(Recibido el 19-01-2018. Aprobado el 03-04-2018)

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Abstract. The aims of this study were to investigate influences of energy inputs and energy forms on output levels and evaluation of inputs sensitivity for rice production in Mazandaran province, Iran. The sensitivity of energy inputs was estimated using the marginal physical productivity (MPP) method and partial regression coefficients on rice yield. Data were collected from 72 rice farms in September 2016. The sample volume was determined by random sampling method. Total energy input was found to be 61.23 GJ ha−1 and total energy output was calculated as 139.11 GJ ha−1. The highest average energy consumption of inputs was for Irrigation canal (40.51 GJ ha−1) which was accounted for about 66% of the total energy input. Econometric model evaluation showed that the machinery energy was the most significant input affecting the output level. Sensitivity analysis results indicate that with an additional use of 1 MJ of each machinery and Toxin energy, would lead to an additional increase in yield by 0.903 and 0.511 kg, respectively. The MPP of human labor and seeds was negative. It can be because of applying the inputs more than required or improperly applying.

Keywords. Rice, Sensitivity of energy, Cobb–Douglas, Iran

Citar, estilo APA: Bahrami, H., Cherati, F. & Barkhordari, S. (2018).Energy use and sensitivity analysis of energy with economical models for rice production in Iran semi-mechanized system. *Revista QUID (Special Issue)*, 18-27.

1. INTRODUCTION

Rice (Oryza sativa L.) is the staple food of more than a half of the world population (Sinha and Talati, 2007; Ginigaddara and Ranamukhaarachchi, 2009). The global rice production is 454.6 million ton annually, which has a yield of 4.25 ton/ha. The average yield is about 4.9 ton/ha in Iran, which is the 11th rice producer in the world (IRRI, 2016). However, Iran consumes about 2.05 million ton of its production inside the country. For the last decades, rice consumption has been expanding beyond the traditional rice-growing areas, particularly in western Asia and Europe. In most countries, surveillance measures are taken regarding the presence of different elements in important foodstuff (Samadi Maybodi and Atashbozorg, 2006).

Efficient use of energy is one of the principal requirements of sustainable agriculture. Energy use in agriculture has been increasing in response to increasing population, limited supply of arable land, and a desire for higher standards of living. Continuous demand in increasing food production resulted in intensive use of chemical fertilizers, pesticides, agricultural machinery, and other natural resources. However, intensive use of energy causes problems threatening public health and environment. Efficient use of energy in agriculture will minimize environmental problems, prevent destruction of natural resources, and promote sustainable agriculture as an economical production system (Erdal et al., 2007).

Modern farming has become very energy intensive; therefore there is a great need to balance the use and availability of energy (Singh et al., 2000). Production functions are central to the determination of the efficient allocation of resources. Many researchers have studied energy analysis and relationship between inputs and yield to determine the energy efficiency of plant production. Singh et al. (2000) applied different mathematical functions to establish relationship between the yield and total energy input for cotton. Their result showed that the average yield of cotton can be increased by 6±8% with an additional energy input of 1±3%, mainly through tillage, irrigation and spraying. Singh et al. (2004) studied energy use for wheat crop in India. They applied Cobb–Douglas function to establish relationship between energy inputs and yield and accounted regression coefficients and marginal physical productivity for each of energy inputs. Mohammadi et al. (2010) estimated the production function of kiwifruit. They investigated different functions in order to analyze the relationship between energy inputs and energy output and at last the Cobb–Douglas function was selected as the suitable function. Results revealed that energy inputs of human labor, water for irrigation, total fertilizer and machinery contributed significantly to the yield. The impact of human labor energy was found to be the highest among the other inputs in kiwifruit production. Mohammadi and Omid (2010) studied energy inputs–yield relationship for greenhouse cucumber production in Iran. The regression results revealed that the contribution of energy inputs on yield (except for fertilizers and seeds energies) was significant. Mobtaker et al. (2010) investigated the energy consumption and inputs sensitivity for barley production in Iran. Econometric model evaluation showed that machinery energy was the most significant input which affects the output level. As well, sensitivity analysis indicates that MPP of biocides energy was negative. Rafiee et al. (2010) determined the energy balance between the energy inputs and yield for apple production in Tehran, Iran. Results showed the energy input of diesel fuel had the biggest share within the total energy inputs. The impact of human labor, farmyard manure, water for irrigation, electricity and chemical fertilizer energy inputs was significantly positive on yield. Although many studies have conducted on energy use in agricultural crops (Tsatsarelis, 1993; Mandal et al., 2002; Yilmaz et al., 2005; Jianbo, 2006; Strapatsa et al., 2006; Cetin and Vardar, 2008; Mohammadi et al., 2008), there is no any study on the energy consumption and sensitivity analysis for alfalfa production in Iran.

Kennedy (2001) compared rice production in Japan with California in America. In Japan 640 labor-h and 90 L of fuel per ha were consumed, but in USA for rice production 24 labor-h and 310 L of fuel per ha was consumed. Product performance in both countries has equal and high level. In Japan the high performance is in result of large amounts of fertilizer consumption and in the United States in result of high yielding varieties is Energy ratio in Japanese system was 2.8 and in the American system 2.1. Yoo and Yeony (1991) compared three rice cultivation systems in South Korea. Fusion system while reducing energy input than the other two systems performance similar to conventional systems, automated systems of the two higher energy efficiency is desired.

Cherati et al. (2011) compared two rice cultivation systems in Iran. Results showed that the total energy used for semi-mechanized and traditional rice production system was 67217.95 and 67356.28 MJ/ha, respectively.

The aims of this study were to determine the amount of energy use and the relationship between energy inputs and yield of rice production in Iran. Also sensitivity analysis of energy inputs for rice crop production was investigated and the Marginal Physical Product technique was utilized to analyze the sensitivity of energy inputs on rice yield.

2. MATERIALS AND METHODS

The study was conducted on 72 rice farms in the Mazandaran Province of Iran. Data were collected from the farms using a face to-face questionnaire technique on September 2016. The Province is located between 35° 47' and 36°35' north latitude and 50° 34' east longitude. Data were collected from the farms using a face-to-face questionnaire technique. The size of each sample was determined using Equation 1 derived from Neyman method (Yamane, 1967):

$$n = \frac{\left(\sum N_h S_h\right)}{N^2 D^2 + \sum N_h S_h^2} \qquad (1)$$

Where: n: sample size required, N: number of the beneficiary population of Nh: the number of people in the class h, S2h: class standard deviation h, Sh2: Class variance, d: making accuracy $(x - \overline{X})$, Z: reliability (95%), D2 is: D2 = d 2 / z 2

Rice usually all around the world in two ways: indirect and direct culture (Awan et al., 2007). Indirect culture consists of rice cultivation in nursery and then transplant to the land transfer if the original is in direct seeding cultivation technique directly on the main land is cultivated. The original ground indirect method has been previously prepared.

The questionnaires included total energy inputs from different sources and yield weight. The inputs used in the production of rice were specified in order to calculate the energy equivalences in the study. Inputs in rice production were: human labor, machinery, diesel fuel, chemical fertilizers, biocides, electricity and seeds. It should be mentioned that the free sources of energy (solar energy input for photosynthesis) are not accounted. The output was dry hay (15% w.b.). To calculate the energy equivalent of inputs and output, units in Table 1 were used.

Table 1. Energy equivalents for different inputs and outputs in rice production.

Items	Unit	Energy equivalent (MJ/unit)	Reference
Input			
Fuel	L	56.31	(cherati et al., 2011; Erdal et al., 2007)
Machinery	h	64.80	Singh (2002); Hatirli et al. (2006)
human labor	h	2.31	(Yaldiz et al., 1993)
Chemical fertilizers			
Nitrogen fertilizer (N)	kg	60.6	(Esengun et al., 2007)
Phosphate fertilizer (P2O5)	kg	11.93	(Esengun et al., 2007)
Potassium fertilizer (K2O)	kg	6.7	(Esengun et al., 2007)
Toxins			
Pesticides	kg	101.2	(Yaldiz et al., 1993)
Herbicide	kg	238	(Pathak and Binning, 1985)
Fungicides	kg	216	(Pathak and Binning, 1985)
Seed	kg	17	(Singh and Mital, 1992)
Irrigation canal	m^3	4.184	(cherati et al., 2011)
Output			
Paddy	kg	14.7	(Moradi and Azarpour, 2011)
Straw	kg	12.5	(Moradi and Azarpour, 2011)
Husk	kg	13.8	(Moradi and Azarpour, 2011)

In order to obtain a relationship between inputs and yield, a mathematical function needs to be specified. For this purpose different functions were investigated and finally Cobb–Douglas production function was selected; because it produced better results (yielded better estimates in terms of statistical significance and expected signs of parameters). The Cobb–Douglas production function is frequently used in both energy and economics studies to show the relationship between input factors and the level of production (Singh et al., 2000; Singh et al., 2004; Mohammadi and Omid, 2010; Mobtaker et al., 2010). This function is nothing but the logarithmic function. Logarithmic functions are used where changes of variables in the model show as many folds compared to one another. The coefficient of variables in this function which is in log form also represents elasticities (Mohammadi and Omid, 2010). Also, it is easy to analyze, and it seems to be a good approximation for actual productions (Singh et al., 2000). The Cobb–Douglas production function is expressed as:

$$Y = f(x)\exp(u) \quad (2)$$

Eq. (2) can be further re-written as:

$$\ln Y_i = a + \sum_{j=1}^{n} a_j \ln(X_{ij}) + e_i \qquad i=1,2,\ldots,n \quad (3)$$

Where Yi is the yield of the ith farmer, Xij, the inputs, equivalent costs used in the production process, a, the constant term, αj, coefficients of inputs which are estimated from the model and ei is the error term.

Assuming that when the energy input is zero, the crop production is zero too, Eq. (3) is reformed to (Singh et al., 2003; Hatirli et al., 2006; Mohammadi and Omid, 2010):

$$\ln Y_i = \sum_{j=1}^{n} a_j \ln(X_{ij}) + e_i \quad (4)$$

In the present case, n=7; therefore Eq. (4) can be expressed in the following form:

Energy demand in agriculture can be divided into direct energy (DE), indirect energy (IDE), renewable energy (RE) and non-renewable energy (NRE). Direct energy is directly used at farms and on fields. Indirect energy, on the other hand, consists of the energy used in the manufacture, packaging and transport of fertilizers, pesticides and farm machinery (Ozkan et al., 2004). The DE includes human labor, diesel fuel while the IDE covers chemical fertilizers, biocides, machinery, Irrigation and seeds used in the rice production. Renewable energy includes human labor, seeds and non-renewable energy consists of machinery, diesel fuel, chemical fertilizers, biocides and Irrigation.

$$\ln Y_i = a_1 \ln X_1 + a_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X_5 + \alpha_6 \ln X_6 + a_7 \ln X_7 + e_i \quad (5)$$

Where Xi stand for corresponding energies as X1, human labour; X2, diesel fuel; X3, water of irrigation; X4, chemical fertilizers; X5, biocides; X6, machinery; X7, seed.

The effect of direct, indirect, renewable and non-renewable energies on production was also studied. For this purpose, Cobb–Douglas function was determined as Eqs. (6) and (7):

$$\ln L_i = \beta_1 \ln DE + \beta_2 \ln IDE + e_i \quad (6)$$

$$\ln L_i = \gamma_1 \ln RE + \gamma_2 \ln NRE + e_i \quad (7)$$

Where Li is the ith energy output; DE, IDE, RE and NRE are direct, indirect, renewable and nonrenewable energies used for rice production, respectively. βi and γi are coefficient of exogenous variables.

Eqs. (5)- (7) were estimated using ordinary least square technique. The Marginal Physical Product (MPP) technique, based on the response coefficients of the inputs, was utilized to analyze the sensitivity of energy inputs on rice yield. The MPP which is a factor indicates the change in the output with a unit change in the factor input in question, keeping all other factors constant at their geometric mean level. The MPP of the various inputs was computed using the αj of the various energy inputs as (Singh et al., 2004):

$$MPP_{xj} = \frac{GM(Y)}{GM(X_j)} \times a_j$$

Where MPPxj is marginal physical productivity of jth input, αj, regression coefficient of jth input, GM(Y), geometric mean of yield, and GM (Xj), geometric mean of jth input costs on per hectare basis.

A positive value of MPP of any factor indicates that with an increase in input, production is increased and a negative value of MPP of any factor input indicates that additional units of inputs contribute negatively to production. Hence, it is better to keep the variable resource in surplus rather than utilizing it as a fixed resource (Singh et al., 2004).

In production, returns to scale refer to changes in output subsequent to a proportional change in all inputs (where all inputs increase by a constant factor). In the Cobb–Douglas production function, it is indicated by the sum of the elasticities derived in the form of regression coefficients. If the sum of the coefficients is greater than unity ($\sum_{i=1}^{n} a_i \rangle 1$), then it could be concluded that the increasing returns to scale; if the function becomes less than unity (

$\sum_{i=1}^{n} a_i \langle 1$), then it is indicated that the decreasing returns to scale; and, if the result is unity ($\sum_{i=1}^{n} a_i = 1$), it shows that the constant returns to scale (Singh et al., 2004).

Basic information on energy inputs and rice yields were entered into Excel's spreadsheet and SPSS 16.0 software. Modeling carried out using linear regression technique.

Table 2. Amounts of inputs, outputs and energy inputs and output in rice production

Inputs (unit)	Quantity per unit area (ha)	Total energy equivalent (GJ ha^{-1})
Input		
Fuel(L)	98.30	5.54
Machinery(h)	50.86	3.30
human labor (h)	762.70	1.76
Chemical fertilizers (kg)	282.53	8.12
Nitrogen fertilizer (N) (kg)	109.66	6.65
Phosphate fertilizer (P2O5) (kg)	61.05	0.73
Potassium fertilizer (K2O) (kg)	111.83	0.75
Toxins (kg)	4.40	0.84
Pesticides (kg)	1.36	0.14
Herbicide (kg)	2.09	0.50
Fungicides (kg)	0.95	0.21
Seed (kg)	68.06	1.16
Irrigation canal (m^3)	9683.31	40.51
The total energy input (GJ)		61.23
Output		
Paddy (ton)	4.336	63.75
Straw (ton)	5.027	62.85
Husk (ton)	0.906	12.51
Total energy output (GJ)		139.11

3. RESULTS AND DISCUSSION

Table 2. shows the quantities of inputs used in whole production life (4 years) and establishment of rice production and their energy equivalences. Also Figure. 1 shows the distribution percent of the energy associated with the inputs. The results revealed that around 763 h of human labor and 51 h of machinery power per hectare were required to produce rice in the research area. The total energy input for various processes in the rice production was calculated to be 61.23 GJ ha−1. The highest average energy consumption of inputs was for Irrigation canal (40.51 GJ ha−1) which was accounted for about 66% of the total energy input (Figure. 1), followed by chemical fertilizers (8.12GJ ha−1, 13%). Having deep wells in the region and not using modern efficient irrigation methods are among the reasons of high consumption of Irrigation energy in the studied region. In order to reduce the Irrigation consumption, using of modern methods of irrigation with high efficiency (which leads in saving water consumption) can be suggested.

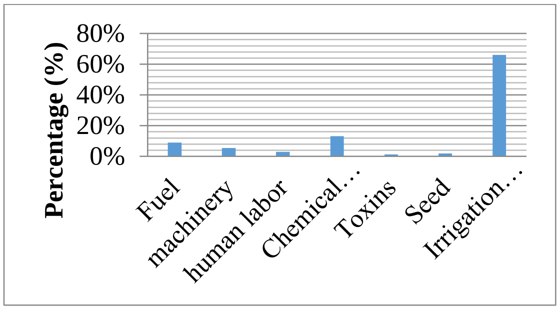

Figure. 1. The share and amount (GJ ha−1) of energy inputs for rice production in Mazandaran, Iran.

2.2. How to choose criteria and scoring

Several factors are involved in determining the location of a pumping station. These factors could be hydraulic characteristics or other considerations. In this research, considering the goal of evaluating the four stations of water pumping from the point of view of defective defense. Table 1 presents the name and position of the four pumping stations examined. Among the different criteria of this research, four criteria that were considered by the experts as the basic and challenging criteria of the city of Mashhad were raised.

The energy share of nitrogen fertilizer was about 81.90 % of total energy of used chemical fertilizer. As rice is a leguminous and nitrogen fixing plant, the nitrogen fertilizer can be substituted by other fertilizers such as potassium and phosphorus, this can lead to less consumption of energy. The energy consumption was minimum for Phosphate (730 MJ ha−1) which accounted for about 8.99 % of the total energy consumption.

Table 3. Econometric estimation results of inputs.

Endogenous variable: yield		Coefficient	*t-ratio*	MP
Exogenous variables				
Model 1:				
$\ln Y_i = a_1 \ln X_1 + a_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X_5 + \alpha_6 \ln X_6 + a_7 \ln X_7 + e_i$				
Fuel		0.522	1.512	0.409
Machinery		0.686	3.821 **	0.903
Labor human		-0.01	-0.050	-0.02
Chemical fertilizers		0.607	4.180 **	0.324
Toxins		0.099	1.454	0.511
Seed		-0.620	-3.375 **	-2.324
Irrigation canal		0.471	2.829 **	0.050
Durbin-Watson		1.577		
R^2		0.998		
Return to scale $(\sum_{i=1}^{n} a_i)$		1.755		
*, ** Indicates significance at 1% and 5% level, respectively.				

The consumption of human labor after seed was only 2.15 % (1.76 GJ ha−1). Similar results have been reported in the literature implying that the energy input of human labor has a little share of total energy input in agricultural production (Sartori et al., 2005; Strapatsa et al., 2006; Kizilaslan, 2009). The average yield of rice (for 4 years) was obtained to be 4.336 t ha−1, accordingly, the total energy output per hectare was calculated as 139.11GJ ha−1 (Table 2).

The share of energy input as direct, indirect, renewable and nonrenewable forms is illustrated in Figure. 2. The total consumed energy input could be classified as indirect energy (88 %), and direct energy (12 %) or renewable energy (4.50 %) and non-renewable energy (94.8 %). This indicates that rice production depends mainly on non-renewable energy (irrigation, diesel fuel and chemical fertilizers) in the studied area. Therefore, it is clear that non-renewable energy consumption was higher than that of renewable in rice production, which is in agreement with the literatures for different crops (Yilmaz et al., 2005; Erdal et al., 2007; Kizilaslan, 2009; Mobtaker et al., 2010). Since the main non-renewable inputs were irrigation and chemical fertilizers, efficient use of water and management of plant nutrients using renewable resources like farmyard manure would increase the rate of renewable energy.

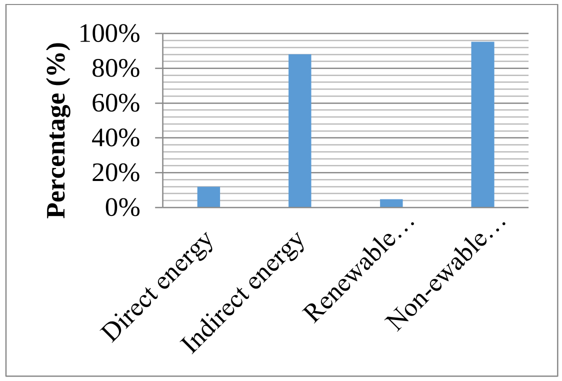

Figure. 2. The share and amount (GJ ha−1) of total energy input in the form of direct, indirect, renewable and Non-renewable for rice production in Mazandaran, Iran.

Regression results for Eq. (5) are shown in Table 3. For data used in this study, autocorrelation was tested using Durbin–Watson method (Hatirli et al., 2005; Mohammadi and Omid, 2010). The Durbin–Watson value was found to be 1.577 for Eq. (5) which indicates that there was no autocorrelation at the 5% significance level in the estimated model. The R2 value was determined as 0.998 for this equation, implying that around 0.998 of the variability in the energy inputs was explained by this model.

The results of assessment of Cobb–Douglass function on each inputs in rice production indicates that the impact of each inputs differ in constitution of yield. The results revealed that the impact of energy inputs could have positive effect on yield (except for human labor and seed). As it can be seen from Table 3, Machinery had the highest impact (0.686) among the other inputs and significantly contributed on the yield at 1% level. It indicates that a 1% increase in the energy machinery input led to 0.686 % increase in yield in these circumstances. The second important input was found to be the diesel fuel with 0.607 elasticity, followed by fuel and irrigation, with elasticity of 0.522 and 0.471 respectively. Mobtaker et al. (2010) concluded that machinery energy was the most significant input affecting the barley output level in Iran. Hatirli et al. (2006) developed an econometric model for greenhouse tomato production in Antalya province of Turkey and reported that the human labor, chemical fertilizers, biocides, machinery and water energy were important inputs, which significantly contributed to yield.

The human labor and seed had a negative impact on rice yield. The value of return to scale for the model (1) was calculated by gathering the regression coefficients as 1.755. The higher value of return to scale than unity implies increasing return to scale.

The sensitivity of energy inputs on output level was analyzed using the marginal physical productivity method and partial regression coefficients and the results are provided in Table 3. As it can be seen, the major MPP was drown for machinery energy (0.903), followed by Toxins energy (0.511). It indicates that using an additional of 1 MJ either for machinery or Toxins energy would result in increasing the yield by 0.903 and 0.511 kg, respectively. As a consequence, parameters with a large sensitivity coefficient have a strong influence on the state variable. This identifies which factors should be identified and measured most carefully to assess the state of the environmental system, and which environmental factors should be managed preferentially (Drechsler, 1998).

The MPP of human labor and seed energy were found to be -0.02 and -2.324; a negative value of MPP implies that additional units of inputs are contributing negatively to production, i.e. less production with more input. The other important variables that affect rice yield are diesel fuel and chemical fertilizer energy with MPP of 0.409 and 0.324, respectively.

Singh et al. (2004) estimated the sensitivity of energy inputs on wheat productivity for five agro-climate zones in India. They reported that MPP of chemicals in zones 1–5, were calculated to be 0.385, 2.816, -0.211, 0.610 and 0.624, respectively. Rafiee et al. (2010) estimated the sensitivity of energy inputs on apple production in Iran. The results showed that the MPP value of water for irrigation was the highest, followed by human labor and chemicals energy inputs, respectively.

The energy obtained from existing inputs was divided into two direct and indirect forms. The assessed trends of both forms of energy were positive, indicating the positive impacts on the output level. Impact of indirect energy (1.086) was more than that of direct energy (0.211). This impact was significant at 5 % level. The regression coefficient for renewable energy (-0.334) and non-renewable energy (1.078) was significant at 5% level for renewable and 1% level for non-renewable energy. It is concluded that impact of non-renewable energy was higher than that of renewable energy in rice production. Similar results have been reported in the literatures (Mohammadi and Omid, 2010; Unakitan et al., 2010). Durbin–Watson values were calculated as 1.831 and 1.808 for Eqs. (6) and (7), respectively; indicating that there is no autocorrelation at the 5% significance level in the estimated models. The R2 values were found to be 0.998 for both of them.

As it can be seen from Table 4. The MPP of direct, indirect, renewable and non-renewable energy was found to be 4.023, 2.801, -15.919 and 2.572, respectively. This indicates that an additional use of 1 MJ of each of direct, indirect and non-renewable energy would lead to an additional increase in yield by 4.023, 2.801and 2.572kg, respectively. Also, renewable have negative effect that an additional use of 1 MJ of renewable energy would lead to decrease in yield by -15.919. It is concluded that impact of renewable energy was higher than that of renewable energy in rice production. Mohammadi and Omid (2010) and Hatirli et al. (2005) have also reported similar results for greenhouse cucumber production in Iran and energy use in Turkish agriculture, respectively.

The return to scale values for the models (2) and (3) were 1.297 and 0.744, respectively, implying the decreasing return to scale.

Energy management is an important issue in terms of efficient, sustainable and economic use of energy. Optimization is an important way to maximize the amount of productivity, which can significantly impact the energy consumption and production costs. Linear programming is among the ways that can be used to optimize the energy inputs. So, the present study can be extended to determine wasteful uses of energy inputs by inefficient farms and suggest necessary quantities of various inputs should be used by them. More studies in this direction are currently underway.

Table 4. Econometric estimation results of direct, indirect, renewable and non-renewable energies.

Endogenous variable: energy output	Coefficient	*t-ratio*	MPP
Exogenous variables			
Model 2:			
$\ln L_i = \beta_1 \ln DE + \beta_2 \ln IDE + e_i$			
Direct energy	0.211	0.676*	4.023
Indirect energy	1.086	771.941 **	2.801
Durbin-Watson	1.831		
R^2	0.998		
Return to scale $(\sum_{i=1}^{n} \beta_i)$	1.297		
Model 3: $\ln L_i = \gamma_1 \ln RE + \gamma_2 \ln NRE + e_i$			
Renewable energy	-0.334	-2.172 *	-15.919
Non-renewable energy	1.078	775.047 **	2.572
Durbin-Watson	1.808		
R^2	0.998		
Return to scale $(\sum_{i=1}^{n} \gamma_i)$	0.744		
*, ** Indicates significance at 1% and 5% level, respectively.			

4. CONCLUSION

The purpose of this study was to investigate influences of energy inputs and energy forms on output levels and evaluation of inputs sensitivity for rice production in Mazandaran province, Iran. Data were collected from 72 rice farms and the sample volume was determined by random sampling method. Total energy input was found to be 61.23 GJ ha−1 and total energy output was calculated as 139.11 GJ ha−1.

It was founded that the irrigation was the most energy consuming input followed by chemical fertilizers. The share of non-renewable energy was higher than that of renewable energy consumption. Econometric estimation results revealed that machinery had the highest impact (0.686) among other inputs and significantly contributed on yield at 1% level. The estimated MPP for machinery energy was the biggest among inputs of energy and MPP of Human labor and seed energy was negative. The MPP of direct, indirect, renewable and nonrenewable energy were found to be 4.023, 2.801, -15.919 and 2.572, respectively.

Optimal consumptions of irrigation, chemical fertilizers and other major inputs would be useful not only in reducing negative effects to environment, but also in maintaining sustainability. Lack of soil analysis in the area leads to unconscious usage of chemical fertilizer. In order to reduce the irrigation consumption, using of modern methods of irrigation with high efficiency (which leads in saving water consumption) can be suggested. Also it is suggested that new policies are to be taken to reduce the negative effects of energy inputs such as plant, soil and climate pollution. Therefore, analysis of energy consumption is an important task.

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