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Evaluation of Economy and Compared Energy Efficiency on Grape in West Azerbaijan Province

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Abstract: A way of estimation agriculture development and product stability agricultural location is using of energy flow method. In this consideration, energy flow at agricultural ecosystems of 2 grape in cities from west Azerbaijan province was compared. The related data of inputs and outputs for evaluation of energy efficiency in these gardens are become equivalent value of input and output energy efficiency. Energy value of used factors and input in grape gardens of Urmia and sardasht were 6417773 and 862570 k cal ha^{-1}, respectively and output (production) energy value of the gardens were 25632600 and 10123800 k cal ha^{-1}, respectively. Energy efficiency values (output: input ration) were 3.99 and 11.7, respectively. Data showed in grape gardens of Urmia the most use of energy were nitrogen fertilized usage and irrigation. In grape gardens of sardasht the most use of energy was nitrogen fertilized. In general, because of the climate conditions, topography and society culture in these regions the difference in energy efficiency of these gardens almost was reasonable. The number of inputs increases; effect increases any one of input decrease. Grape garden system of sardasht hasn't any contamination and agricultural systems because of much annual rainfall in this region are dry farming. Therefor, costs of irrigation and poisoning are deleted but inordinately poisoning of Urmia gardens result in contamination and transformed these ecosystems.

Key words: Energy efficiency, output, input, grape

INTRODUCTION

Agricultural ecosystems are related to economical and society condition widely, that there are in the world. The major of agricultural ecosystems management are maximum energy flow and human service materials (Energy cycle is a subject of agricultural ecology and in different locations of world, input and output energy is calculated in different agricultural ecosystems, (Heydar and Hassanzadeh, 2003).

Agricultural ecosystems depend on ecological energy and cultivation energy (Kuchaki, 1994), ecological energy source is sun energy that using for photosynthesis, environmental temperature control, atmosphere currents and creating rain (Hassanzadeh *et al*., 2006). Cultivate energy is divisible in 2 groups biological and industrial. Amount of using energy in agriculture depends on changing degree in natural ecosystem. Apprehension distribution energy method is very important in development agricultural design (Hassanzadeh *et al*., 2005). Sun is greater ecological energy source. Biological analyses and energy in agricultural ecosystem, necessary to efficient yield (Tripartitie *et al*., 2001).

Agricultural ecosystems haven't desirable condition. Because at the time of yield harvesting, all mineral elements go out of soil and rest provisions are used to feed domesticated animals, therefore, coefficient return of materials is very low (Hassanzadeh *et al*., 2001; Kuchaki *et al*., 1995). In this case, these ecosystems must be are reclaimed by using chemical and organic fertilizers. On the other hand using of chemical materials such as fertilizers, fungicides and herbicides, make new ecological and economical problems of environmental. These problems particularly in Iran have more importance (Dehganian, 1996; Vlek *et al*., 2004). Iran as one of the developing commercial countries, the most of energy is used for agricultural productions for example, insecticide, fertilizers and machinery. While, human force is main

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energy source and machine power is used less (Vlek *et al*., 2004). The increase of industrial technological application in agriculture caused to increase in energy efficiency basically. Because in this condition fewer lands are released rotation and shortage of nutrients and water is reparable mostly.

Nowadays, the use of fossil fuels as energy in agriculture has specific rolls. Agriculture is depending on fossil fuels energy. Energy efficiency is increased with consumption of fossil fuels although, most energy is used in fossil fuels production. Fossil fuels energy increases amount of yields in land unit (Hassanzadeh *et al*., 2001; Kuchaki, 1994; Pimental *et al*., 1987).

Valadyani *et al*. (2001) express that amount of addition energy efficiency in using nitrogen depends on kind of previous yield, primary amount of nitrogen in the soil and type of weather.

In this study, most of using energy related to nitrogen fertilizer and machinery, respectively. Using of nitrogen with increasing humidity or precipitation is increased.

Punti (1988) in the wheat and sunflower energy efficiency and ecological evaluation comparison showed that in the modern culture available energy from straw is lower than traditional culture.

The main objective of this study, is to analyze the energy efficiencies and economic aspect of the grape in 2 city of west Azerbaijan province, Iran.

MATERIALS AND METHODS

The grape (*Vitis vinifera*) is from *Vitaceae* family. This plant almost are cultured in total Iran regions, Urmia by existence of cold high winter is one of the grape plantation important region in Iran country (Aslany and Hagygat, 1989; Shahrestany, 1998).

Grape is one of exportable important productions in this province (Aslany and Hagygat, 1989; Shahrestany, 1998) on this basis, the study was conducted during 2006-2007 in Urmia and Sardasht areas of the west Azerbaijan province in the North West of Iran.

In this consideration, the energy flow in the agricultural ecosystem of grape was evaluated by 5 years statistics and information derived from the local's agriculture government organization (preparation of questionnaire raises from 25 farmers of any locality). Detail inventory of average different inputs (labor, fertilizer, pesticide, nitrogen, phosphorus, potassium, fungicide and irrigation water) and output (grape yield) was prepared following scrolls, 1994. Various inputs and output data's were converted as output input ratio. So, calculated amount of energy efficiency (input and output ratio) (Hassanzadeh *et al*., 2001, 2005; Rillor and Upadhyay, 1992).

Energy efficiency = Input energy/Output energy

Inputs of Urmia area include labor (to dig of under tree, winter and spring pruning, collecting of lops, repair of streamlets, irrigation, moving of chemical fertilizers, moving of manure, moving to pluck, collecting, putting box, to degree, wrapping, loading and moving, chemical fertilizers, poisoning (pesticide, fungicide) and irrigation. The inputs of Sardasht area include labor (to plough under tree in winter and spring, collecting of lops, moving of chemical fertilizers, fertilization, pruning, to pluck, collecting, putting box, sorting, wrapping, loading and moving), chemical fertilizers (N_2, P_2O_5 and K_2O).

Yield average of Urmia and Sadrasht grape gardens in 2001-2006 agricultural years were 11.900 and 4.700 tons ha^{-1}, respectively. The fix price of each kilo grape in Urmia and Sardasht were 24.8 and 13.3 cents (1 $ = 9000 Rails).

RESULTS

Data showed that energy efficiency (output and input energy ratio) for grape yield in Urmia and Sardasht areas were 3.99 and 11.7, respectively (Table 1). It means that for each unit of using energy 3.99 or 11.7 kcal energy is produced. When the amount of energy for each input was calculated, this result showed that, the most consumption of energy in Urmia gardens was related to nitrogen fertilizer (79.5) and irrigation (28.8), respectively. The most consumption of energy in Sardasht gardens was related to nitrogen fertilizer (75.9) and labor (18.5), respectively. Although, nitrogen fertilizers have low percentage of total input cost but amount of energy use very much. N fertilizer is the most important fertilizer among other fertilizers both in consumption amount in plant and energy making N fertilizer requires a lot of energy. As for making, wrapping and moving, of each kilo N almost 77.5 MJ energy is needed (Vlek *et al*., 2004). Hassanzadeh *et al*. (2006), showed that in sugar beet culture the most consumption of energy was related to irrigation (31.6%) and machinery (23.8%), respectively. The reason is high requirement to water and the growth period is long.

In Urmia area the most labor consumption of energy was related to plough under tree, sorting, wrapping, loading and moving, respectively (Table 2), but in Sardasht it was related to plough of under tree, picking, collecting, sorting, wrapping and fertilization, respectively (Table 3). Because when these are performed number of labor is determinate, so the costs that are used for these inputs are a lot (Table 4), also, the number of labors in this case is more than other cases (Table 5).

In Sardasht area aren't used of poisoning, potassium fertilizer and irrigation. The reason is *Ribes nigrum* is

Table 1: Inputs energy in grape cultivation in Urmia and Sardasht areas (Iran)

	Urmia			Sardasht		
Input	Amount/ha	energy unit^{-1} (kcal)	Kcal ha^{-1}	Amount ha^{-1}	energy/unit (kcal)	Kcal ha^{-1}
Labor	873 h	500	436500	320 h	500	160000
Nitrogen	180.5 kg	17600	3176800	37.2 kg	17600	654720
P_2O_5	62.5 kg	3190	199357	15 kg	3190	47850
K_2O	250 kg	1600	4000000	-	-	-
Poisoning	13 kg	27170	353210	-	-	-
Irrigation	1600 m^3	1157.43	1851888	-	-	-
Total			6417773			862570

Table 2: Grape compounds and energy produce per hectare in Urmia area

	Urmia				
Component	Component (%)	Energy g^{-1} (kcal)	Aount ha^{-1} (kg)	Product energy/ha (kg ha^{-1})	Input/output (energy)
Hydrocarbon	20	4	2380	9520000	1.48
Protein	3.1	4	368.9	14756000	2.29
Oil	1.9	6	226.1	1356600	0.21
Total				25632600	3.99

Table 3: Grape compounds and energy produce per hectare in Sardasht area

	Sardasht				
Component	Component (%)	Energy g^{-1} (kcal)	Amount ha^{-1} (kg)	Product energy/ha (kg ha^{-1})	Input/output (energy)
Hydrocarbon	20	4	940	376000	2.67
Protein	3.1	4	145.7	582800	4.14
Oil	1.9	6	89.3	535800	0.38
Total				10123800	7.19

Table 4: Total costs, net revenue values and income/cost per hectare of grape cultivation (9000 Rails = 1$)

	Urmia (1000 Rials)	Sardasht (1000 Rials)
Avrage cost (2001-2006)	1977.94	216.66
Gross income	2961.77	626.66
Net income	983.83	410
Net income /cost	0.5	1.9

Table 5: Input energy rate and cost per hectare in grape garden

	Urmia		Sardasht	
Input energy	energy use/ ha (%)	cost/ ha (%)	energy use/ ha (%)	cost ha^{-1}(%)
Labor	6.7	26.7	18.5	99
Nitrogen	49.5	0.5	75.9	0.46
P_2O_5	3.1	0.27	5.5	0.46
K_2O	6.2	0.27	-	-
Poisoning	5.5	42.9	-	-
Irrigation	28.8	29.2	-	-
Total	100	100	100	100

native tree of Sardasht, also, is resistant and adapted against undesirable conditions. This tree wildly grows in mountains slope, because in this area a lot of rainfall occurs grape garden aren't irrigated than using of N fertilizers should be according required amount. As, humidity or precipitation increases, using of fertilizers especially N fertilizer are increased. (Rillor and Upadhyay, 1992; Shahrestany, 1998). So, amount of N fertilizer that is used in Urmia garden is more than Sardasht gardens (Table 1).

Sardasht gardens energy efficiency is 3 times as much as Urmia gardens (Table 2 and 3). Using the input per hectare grape garden is very low in Sardasht area. If it can be made like this condition for Urmia gardens, energy efficiency will increase.

DISCUSSION

Although, Urmia has high production but because of more fertilizer consumption, its energy efficiency is low also, more using of N fertilizer will caused increase the N aggregation damaging in grape fruit. Also, using it caused environment contamination (Blamy and Chapman, 1981). Hassanzadeh *et al.* (2005), in other research suggest that amount using energy in potato is a lot The reason is lots of use of using potato seed that healthy seed is adequate and non-uniform dimension seeds and using much human energy.

Consumption of fossil fuels, chemical fertilizers, insecticides and herbicides Induce to release a lot of CO_2 in the atmosphere. In the mean while, chemical fertilizer (Specially N fertilizer), fossil fuels, irrigation pumps and insecticides have the most of CO_2 release, respectively (Vlek *et al.*, 2004). In Urmia there is high yield but energy efficiency is low (Table 2). In Sardasht region there is low yield but energy efficiency is high (Table 3). The reason is consumption of lower inputs. Agriculture in this region is performed in low unity and isn't commercial. If using the inputs is desirable, yield will be increased, on the other hand, whatever using of energy increases, increasing effect of each input is lessening in yield (Kuchaki *et al.*, 1995; Meimandy, 1974).

Among costs calculated for each area, these results obtained that net income and total cost ratio in Urmia and Sardasht grape production is 0.5 and 1.9, respectively (Table 4), this means that for each rails of input cost, the farmer benefits 0.5 or 1.9 rails. When this rate is more, net income is increased.

So, farmers for more grape production and more benefit should use the modern and mechanization methods. Also, the chemical fertilizers should be used exactly (by testing soil).

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