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Evaluation of Onion Cultivation Energy Balance in East Azerbaijan Province

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ABSTRACT

One of the estimating methods of agricultural development and production stability in agricultural locations is the use of energy flow method. In this consideration energy flow in agricultural ecosystems of onion in East Azerbaijan was calculated by the use of gathered information and data via questionnaire and statistics of related Province's agricultural Jihad organization and farms. The related data of inputs and outputs were altered to equal amounts of consumer and productive energy and then energy efficiency was calculated. Energy amounts of used factors and input in this type of cultivation was estimated 22307134 kcal/ha and output (production) energy amount of onion yield was 18594060 kcal/ha. Also energy efficiency value (output/input) was 0.833 percent. Data show that most of the consumer energy of onion cultivation of East Azerbaijan province is related to irrigation water use and chemical fertilizers and energy that used in machinery. In such a condition it is suggested that through precise determining of the vegetable's water need, replacing modern irrigation methods in regard to current methods, preventing irregular use of inputs specially nitrogen fertilizers, applying proper managing methods in dry regions and using fertilizer on the base of soil test and production potential by increasing usage of function, energy could be optimum.

Key words: Energy flow , Input , Output and Onion .

INTRODUCTION

Onion belongs to Alliaceae vegetables and genus, *Allium*. The most important kind of this genus is the ordinary onion, *Allium cepa* (Singh, 1990). This plant is Asia's native plant so it has various ecological groups from the shape and colour point in these regions (Blamy and Champman 1981).

Edible onion is most the important vegetable which is used in different ways. One of onion's importance is producing energy (432.42 kcal/ kg) and its effect on health of society regarding its different vitamins and minerals is noteworthy. Onion as a complementary of main food in a diet is very important. There are many various energy inputs that may lead to increase in production rate or keep that energy resulting from production. This energy in animal and vegetable products arises from planting orders. The land under cultivation of onion in east Azerbaijan was 10528.5 hectares in 2005 and yielded 43 ton per hectare. Agricultural lands are ecosystems in which energy enters as a subsidy such as chemical fertilizers, insecticides, herbicides, irrigation worker and machinery (Hassanzadeh et al. 2002). These inputs show that the use of energy input is changeable with a great degree and depends on the rate of nitrogen use and the kind of crops. Agriculture depends strongly on energy especially

fossil fuels (Kouchaki and Hosseini 1998). So using of fossil energy in agriculture increases energy production (Hassanzadeh et al 2002). Energy analyses in agricultural ecosystems are necessary in order to create useful and effective production (Singh, 1990). Understanding methods of energy distribution in development and designing of agricultural management is important and the necessity of energy and environmental constant management from the ecological point related to development (Hassanzadeh and Arjmand 2006).

Agricultural ecosystem depends on two quite different energy input that is ecological energy contains solar energy which is used in order to photosynthesis, environmental temperature control, creating atmosphere flows and producing rain. All together the need to energy in agricultural cultivation depends on the rate of changes in its natural ecosystem (Heydar-golinezad and Hassanzadeh, 2003). One of the ways of estimating agricultural development and production stability in agricultural areas is the use of energy flow (Schorl, 1994). Evaluation of energy balance, calculating of energy use, determining and discriminating of kinds and rate of used energy can be received to measure of production stability in an agricultural ecosystem.

Peterson et al.(1990) suggested that irrigation and nitrogen use depends on the kind of former yield and the rate of primary nitrogen in soil. In this research the most efficiency of energy for alternation of corn, wheat and soybean was 6.1 but in planting one of these crops the quantity was 4.7. Regarding their statements energy efficiency can be corrected by having available nitrogen from previous years, crop residual and the history of yield cultivation in order getting economical income and decreasing environmental pressures caused by increasing NO3, Nitrogen leaching, water pollution or the increasing of greenhouse gases in the atmosphere. Pimentel et al (1994), by examining energy efficiency of organic and traditional in corn, wheat and potato, reported that the energy efficiency of organic order of corn and wheat as compared with traditional order 29-70 percent has increased. On the contrary potato energy efficiency in traditional fields are 70-93 percent more than organic order.

Hanson et al. (1999) Reported that the energy efficiency increases in a area by increasing use of nitrogen fertilizer up to 180 kg /hectare. They knew the kind of soil and amount of used fertilizer is an important factor because of increasing output energy. But it should be mention that in agricultural ecosystem coefficient of the nutrient cycle is very low because the important part of mineral elements comes out of ecosystem by harvesting agricultural yield and usually plant residual is used as forage. So fertility of this ecosystem is possible only by using chemical or mineral fertilizers (Pimental et al. 1994). While intensive agricultural procedures and more use of chemicals (such as fertilizers, herbicides, insecticides and other poisons) make some economical, environmental and ecological problems also wearing out of top soil, and sub soil pollution by chemicals, damaging of disorder in the wild life station and undesirable effects on the environment (Hulbergen, 2001). Therefore, pollution is one of the several harmful lateral effects of enormous use of energy in modern civilizations. In this research by using questionnaire, collecting information from onion farmers, statistics and information of Agricultural Jihad organization of east Azarbaijan province, average of onion agriculture energy in east

Azarbijan, examination of suitable solutions and their effect on providing necessary energy of human is shown.

MATERIALS and METHODS

The data is collected through making questionnaire, taking information from onion farmers, 25 area of province in which cultivation of onion is common, and use information of agricultural Jihad organization of east Azarbijan. Then using related formulas and inputs energy amount the average of data is mentioned on the base of kilocalorie per hectare and the input and output energy was defined in (table 1 and 2). Except machinery part and using gasoline quantity, the amount of each cause and using inputs in a hectare is calculated by using existed statistics, information and the questions asked farmers (table 1).

The quantity of fuels of used machinery in a hectare was calculated by formula number 1 (Kouchaki and Hosseini 1998).

1) Power in PTO (output of transferring energy) ×0.06×

73= Fergusson copper tractor fuel (a gallon in an hour)

Tractors used in East Azerbaijan Province are mostly English or Rumanian Fergosen tractors 282. These tractors have 70 horse-powers and the power in PTO is a little less than nominal power of the tractor. Here nominal power is stated 75% (Tripathi, and Sah, 2001), with regard to table 3 the whole working hour of machinery is 41. One gallon is 3.78 liter. So the amount of using fuel was calculated through formulas 2 and 3.

2) fergosen copper tractor 285 fuel =0.06 ×70 ×0.75 ×0.75×3.75=8.7 liter in a hectare (Peterson et al., 1990).

3) 8.7×41hour per hectare =356.7 liter used gasoline in a hectare.

In order to estimate weight of machinery in each hectare about one horse power of machine force is needed so tractors weight is equal to about 90000 kilocalories used energy for kilogram (Kouchaki and Hosseini 1998).

Estimating Onion Seed Energy:

On the average, an onion with 148 g weigh has 2g protein, 14g hydrocarbon and 3g fiber percentage of onion compounds which shows in table 3. Using this data, an input energy with a weight of 3000kg onion to plant for seed production is calculated. In table 1 the kind, the quantity and the percentage of compounds with energy quantity for onion defined. The used quantity of onion to produce seed in east Azarbijan province especially is in cities, Oskoo, Azarbijan. Benab, Malkan and Tabriz are about 300kg on average. According to tables 1 and 3 the energy of each kilogram onion and onion seed is calculated 432.4 and 14511.16 kilocalories respectively (Tripathi and Sah, 2001).

RESULTS and DISCUSSION

The stated results in table 2 shows the energy efficiency and the rate of used energy necessary for producing each unit of protein and hydrocarbon compounds in yield, onion (Peterson et al 1990). The existed results show that the rate of energy efficiency (ratio of output to input) for onion yield is about 0.833 % (table 3). That 0.833% energy unit is produced by using an energy unit. According to table 1-4 the rate of used energy in onion plant is high for extra use water because of farmer's knowledge lack and their expectation when have sting the yield and the soil's sandy and saline quality also using more farmhands and more chemical fertilizers (Marjani, 2001). Therefore, farmers economical, motivation to get more yield and income, their lack of attention to fertilizers commends and their not doing tests of soil analysis to determine the exact fertilizers ratio are the causes that make worse crises. It is showed that 12% of the whole agricultural using energy is used by irrigation (Hulbergen, 2001). In the inside of the farm activities that need direct energy irrigation and fertilizing has the most use of energy (Blamy and Champman, 1981). However the most use of energy belongs to the rate of irrigation 39.90% in the onion farm. Extra irrigation causes an increasing in fertilizing of onion. Irrigation energy contains making equipment, erecting the system and pump and transporting equipment or pipe (Peterson et al., 1990). Developing countries pay remarkable subsidy for commercial energy such as coal, oil, gas, electricity. As water of irrigation the effect of these subsides causes extra use of energy (Pimental, 1994).

Regarding the payment of input subsidies of agricultural Jihad organization the use of chemical fertilizers come to rising more every year as in some onion planting regions 400-1000 kg urine is used. This process makes, lessening soil's organic elements, mineralizing soil, weakening microorganism, running the environment, increasing nitrate in the yield, having undesired effects on the health of the farmer and at last imposing related costs on the farmer and pollution under ground waters. Sand usage in direct cultivation of onion causes change of the soil texture. Increasing of cost production and decreasing of keeping power of water soil (Mosavizadeh and Khodadadi, 2002). Also produced energy is few in each kilogram, onion. Because of more water that is in onion (85%). If the produced energy without considering its content for an adult is 2550 kilocalorie a day , according to table 4 produced onion in each hectare can supply the necessary energy of 7291.8 person and produced potato, wheat, and rice in every hectare can supply the need energy of 12627, 9339 and 4864 person respectively a day(Hassanzadeh and Arjmand 2006). Considering that each person needs 60gr protein daily, yields of onion, will supply the need protein of 27person. Most use of energy respectively is related to irrigation (39.9%), chemical fertilizers (19.79%), machinery (16.53%) and fuel or oil (15.31%). The main reason of low energy efficiency in this research is more use of energy to supply needed water which allows most part of the input energy to itself. One of its reasons is that the rate of rain has been decreasing during the past years and the depth of underground water has decreased in the region. So in practice, irrigation of onion is less than real need of the plant (Mosavizadeh and Khodadai, 2002).

The rate of irrigation water in onion agriculture is main increasing use of energy, despite of an increase function in a land unit, more use of fossil energy and other system of food production decrease efficiency of the use of energy comparing to traditional systems that only depend on the human force or animal. Although traditional systems can not supply food need of population as it grows rapidly stable from the ecological points. Today salinity of soil and irrigation water is between important hindrances especially onion in Iran and east Azerbaijan. According to the existed statistics land measure of saline soil used in the agricultural of the country (4 more than 32 dSm/meter) is more than 7.3 million hectare (Hanson et al., 1999). One of the reasons is low average of onion yield in Asian countries such as Iran especially East Azerbaijan province, comparing to European countries, Central and North America salt and a1kaline effected of soil. Because of low knowledge of onion farmers in using to transplanting instead of direct culturing method (Mosavizadeh and Khodadadi, 2002). So that efficiency of the output energy transformation in plants in natural condition is about 2-3 percent, in agricultural ecosystems is about 9 percent and in unfertile ecosystems is less than 1 percent (Hassanzadeh et al., 2002).

Solution to Increasing Product and Output of Onion Functions in the Province:

Planting suitable kinds of onion variety has worthy part in the average of the yield. each kind of onion is suitable for a particular region and climate of environmental effect on the agricultural plants, it can be used to formulizing fertilizer, because with less input rate, the increasing of the use of mineral fertilizers has a considerable effect on the functions of agricultural plant decrease rapidly (Astaraie, 1999). Using green and compost fertilizer and suitable management of farm in order to minimize the use of chemical fertilizers and their quantity depend on soil quality and rate of irrigation water. Efficiency of using nitrogen fertilizers is increased by suitable management. Economizing in the use of fuel through minimum plugging, transforming method of planting in onion from traditional to modern (Hassanzadeh and Arjmand, 2006) and planting in true time have the highest function in onion (Pimental et al., 1994). Following points should be considered to get maximum function and minimum use of energy:

- Not planting onion in saline soil.
- Not planting onion by direct method: because transplanting is a suitable solution to prevent use of sand to cover seed in direct method of onion cultivation and to increasing the production. Therefore the advantages of planting onion are: low used seed, no use of sand, equal planting intervals, low costs of weeding and scattering, abandoning and low use of poisons, high economical function, increasing productivity, early ripeness of the yield, harvest of the yield on time.
- Exact determining dry regions and substituting modern irrigation methods to other methods.
- Economizing in the use of water through shortening growth period in dry regions.
- Use of fertilizers on the base of soil analysis test and production potential of the region.

Table 1. Rate of energy on the base of kilocalorie to produce onion seed in east Azerbaijan (2005-2006).

Kind of energy	Quantity /ha	Energy/ unit (kcal)	Total energy(kcal/ha)
Machinery	15h	90000	1350000
Fuel	130.5 lit	9583	12505881.5
Human force	328 h	465	152520
Onion seed	300 kg	432.42	1297260
Nitrogen	250 kg	17600	2323200
Phosphorus	100kg	3190	76560
Potassium	50 kg	1600	44000
Herbicide (ronstar)	1.5 lit	99910	149865
Insecticide (dorsban)	3 lit	8610	173820
Irrigation energy	1666.67 kw/h	2004	3340006.68
Total	-----	---	10157813

Economical motivations of farmers to get more yield and income, their lack of attention to fertilizer commends and not doing tests of soil analysis to determine the exact fertilizer ratio are the causes that makes the worse (Astaraie, 1999). At last it can be said that regarding irregular use of chemical fertilizers which in this research used the most energy after irrigation (19.790 %) onion productions through traditional method pollution the air, underground water, environment and other elements in a long period of time. These fertilizers should be used in the best way. Otherwise, it causes high energy efficiency in the farm.

Table 2. Onion compounds with quantities and energy on the basis of kilocalorie

Compounds	(%)	Quantity (kg)	Energy/gram	Energy / kilogram
Protein	10.52	13.5	4	54.06
Hydrocarbon	73.68	94.59	4	378.36
Fiber	20.27	20.27	--	-----
Total	100	------	8	432.42

Table 3. Produced and used energy on the base of kilocalorie to produce onion of east Azerbaijan province during 2005-2006

Kind of used energy	Quantity/ha	Energy/unit (kcal)	Total energy (Kcal/ha)
Machinery	41h	90000	360000
Fuel	356.7 lit	9583	34182568
Human force	1567h	465	728655
Seed	15.5 kg	14511.16	224923
Nitrogen	450 kg	17600	4285600
Amino phosphate	150 kg	3190	114840
Potassium sulphate	200 kg	1600	17600
Herbicide (Nabu-s)	4 Lit	99910	399640
Insecticide (Dorseban)	6 Lit	86910	521460
Fungicide (kapetan)	2 kg	4200	8400
Irrigation water	4440 kw/h	2004	8897760
Total	-------	324761.22	23307134

Table 4. Energy efficiency of onion agriculture in East Azerbaijan Province during agricultural tear of 2005-2006

Onion production (kg/ha)	Produced energy (Kcal)	Input energy (Kcal)	Energy efficiency (input/output)
43000	18594060	22307134	0.833

Table5: Percentage of used energy of all of the causes and inputs in puts in farms of onion production in east Azerbaijan province

Kind of used energy	Percentage from the whole
Machinery	16.53
Fuel	15.31
Human force	3.26
Seed	1.04
Nitrogen	19.20
Amino phosphate	0.51
Potassium sulphate	0.08
Herbicide (Nabu-s)	1.8
Insecticide (Dorseban)	2.33
Fungicide (kapetan)	0.04
Irrigation water	39.9
Total	100

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