The Economic Effects of Organic Agriculture in Reducing the Emission Greenhouse Gases

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Introduction

Agriculture is both a producer and consumer of energy. It uses large quantities of locally available non-commercial energy, such as seed, manure and animate energy, as well as commercial energies, directly and indirectly, in the form of diesel fuel, electricity, fertilizer, plant protection, chemical, irrigation water, machinery etc. Efficient use of these energies helps to achieve increased production and productivity and contributes to the profitability and competitiveness of agriculture sustainability in rural living (Singh *et al*., 2002). Future agricultural sustainability will be achieved from an equilibrated solution of many productive, environmental, and economic issues (Park and Seaton,1996). Among these, improved energy efficiency and reduced greenhouse gas (GHG) emissions are fundamental (Dyer and Desjardins, 2003; Alluvione et al.,2011). While the energy requirements of agriculture are low compared to other production sectors (Tol*et a*l., 2009), realizing efficient use of its own energy needs is pivotal to achieving economic sustainability and GHG emission reductions (Alluvione*et al*., 2011).

Usually, input–output energy analysis is used to evaluate the efficiency and environmental impacts of the production systems. Therefore, there was an immediate need to carry out such analysis for future steps to be taken for any improvement in production systems regarding the energy values of the inputs and the output. By reaching beyond agricultural boundaries and including all the steps of crop input production, energy analysis is a useful indicator of environmental and long-term sustainability (Alluvione*et al*., 2011).

Energy use is one of the key indicators for developing more sustainable agricultural practices (Streimikiene*et al*., 2007) and efficient use of energy is one of the principal requirements of sustainable agriculture (Kizilaslan, 2009). It is important, therefore, to analyze cropping systems in energy terms and to evaluate alternative solutions, especially for arable crops, which account for more than half of the primary sector energy consumption (Sartori*et al*., 2005).

Research problem:

Misuse of agricultural production inputs from fertilizers and chemical pesticides, leading to increased emissions of greenhouse gases.As well as the high cost of applying good practices in agriculture.

Research objective:

That the application of policies and practices to reduce greenhouse gases in agriculture can be carried out at low or even cost-free costs for farmers in the developing world and, in some cases, can raise their productivity while making them less vulnerable to climate change and thereby provide security World Food.

The main objective of this study is to examine energy use pattern and specification of GHG emission for organic and traditional tomato production in Egypt.

2-Materials and methods:

Organic agriculture as an alternative approach to maximize the performance of renewable resources and increase the flow of food and energy in agro-ecosystems.Life cycle assessments show that emissions from conventional production systems are always higher than organic systems, and the question is whether organic agriculture reduces greenhouse gas emissions from agricultural production. What is the yield of the expansion of cultivated areas with organic farming systems?

This research aims at clarifying the importance of organic agriculture in mitigating the effects of greenhouse gases through a comparative study of tomato yield in organic and traditional farming systems in Egypt, as well as the study of energy use patterns and the analysis of inputs and outputs for organic and traditional tomato production.

A survey was carried in 2017by interviewing 30 Farmers in Ismailia governorate. The greenhouses were selected for energy analysis and efficiency of tomato. The selection of Farmers was based on random sampling method. In the village of Sarbiom, Abo Sultan and ElQantra Shark.

Firstly, the amounts of inputs such as (pesticides, human power, machinery, total chemical fertilizers and manure, diesel fuel, seed and irrigation water) used in production of tomato were specified in order to calculate the energy equivalences in the study. The values in (Table 1) were used to find the input amounts. The amounts of the inputs were calculated per Feddanand then, these inputs data were multiplied by the coefficient of energy equivalent. Previous studies were used to determine the energy equivalents coefficients. These sources are given in (Table 1).

The energy equivalences of unit inputs are given in mega joule (MJ) per unit. The total input equivalent can calculate by adding up the energy equivalences of all inputs. Based on the energy equivalents of the inputs and output (Table 1), the energy ratio (energy use efficiency), energy productivity, specific energy and net energy gain were calculated (Singh *et al.*, 2002):

Diesel energy requirement was determined on the basis of fuel consumption, L /h. The data were converted into energy units and expressed in MJ/fed. The following equation was used in the calculation of fuel consumption (Canakci M 2005):

$$FC = P_m \times R \times SFC$$

Where FC is the fuel consumption,L /fed; P_m is the tractor power, kW; R is the loading ratio, decimal; and SFC is the specific fuel consumption (0.300 L kW/h).

In this study the fuel requirements of water pumps (stationary type) and combine harvesters were measured by the following method: the fuel tank of the engine was completely filled before starting the field test, and the quantity of fuel required to fill the tank after performing the field test was measured using a one L graduated cylinder. Thus, the fuel consumed during the test was determined (Canakci M 2005).

Based on the energy equivalents of the inputs and output (Table 1), the energy ratio (energy use efficiency), energy productivity, specific energy and net energy gain were calculated (Mohammadi A 2010)

$$\text{Energy ratio (Energy use efficiency)} = \frac{\text{Energy Output (MJ/ fed)}}{\text{Energy Input (MJ /fed)}}$$

$$\text{Energy productivity} = \frac{\text{Yield (kg /fed)}}{\text{Energy Input (MJ /fed)}}$$

$$\text{Specific Energy} = \frac{\text{Energy Input (MJ/ fed)}}{\text{Yield (kg /fed)}}$$

Net energy = Energy Output (MJ/ fed) - Energy Input (MJ/ fed)

Table :1 Energy equivalents for different inputs and outputs in agricultural production

Energy source	Units	MJ*	References
1. Human power	-		
Man	h	1.96	De D, Singh 2001
Woman	h	1.57	De D, Singh 2001
2. Chemical fertilizer	-	-	
N	kg	66.14	De D, Singh 2001
P_2O_5	kg	12.44	De D, Singh 2001
K_2O	kg	11.15	De D, Singh 2001
3. Diesel fuel	L	47.8	Hetz EJ. 1998
4. Tractor	h	93.61	Hetz EJ. 1998
5. Agricultural machinery	h	62.7	Hetz EJ. 1998
6. Combine	h	87.63	Hetz EJ. 1998
7. Chemical poison	kg	-	
Herbicides	kg	238	Singh JM. 2002
Fungicides	kg	216	Singh JM. 2002
Insecticides	kg	101.2	Singh JM. 2002
8.Farmyard manure	kg	0.3	Shrestha DS. 1998.
9.Nylon	kg	60	Hetz EJ. 1998
10. Seed	-	-	
11. Water for irrigation	M^3	1.02	Singh JM. 2002
Tomato	unit	1.00	GhasemiMobtaker H 2010
12. **Electricity**	kWh	11.93	Singh JM. 2002
Tomato	kg	1.00	GhasemiMobtaker H 2010
13. Output	-	-	
Tomato	kg	0.8	Yaldiz O 1993

Note:*The joule is the derived unit of energy in the International System of Units.

***The megajoule (MJ) is equal to one million (10^6) joules, or approximately the kinetic energy of a one**

Megagram (tons) vehicle moving at 161 km/h.

Source: References in columns four

The output-input energy ratio (energy use efficiency) is one of the indices that show the energy efficiency of agriculture. In particular, this ratio, which is calculated by the ratio of input fossil fuel energy and output food energy, has been used to express the ineffectiveness of crop production in developed countries (Unakitan G 2010). An increase in the ratio indicates improvement in energy efficiency, and vice versa. Changes in efficiency can be both short and long term, and will often reflect changes in technology, government policies, weather patterns, or farm management practices. By carefully evaluating the ratios, it is possible to determine trends in the energy efficiency of agricultural production, and to explain these trends by attributing each change to various occurrences within the industry (Unakitan G 2010).

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Results And Discussion

Energy Use Pattern

The components of the energy use pattern for cultivating traditional tomato are shown in (Table 2)76 kg nitrogen, 45 kg Phosphate, 96 kg potassium, 505L diesel fuel, 1880 m3 water, 71.6 kg chemical spraying agents, 1200 h human power, 25 h machinery, per fedden are used for the production of traditional tomato in Ismailia governorate

The average traditional tomato output were found to be 24000 kg /fed. The energy equivalent of this is calculated as 19200 MJ/fed. Finally, the energy used in the production of traditional tomato consists of 18.7% chemicals, 5.2 % human power, 3.5 % machinery, 14.8% fertilizers, 53.6% fuel (diesel) and 4.3% water inputs. The highest energy input is provided by diesel fuel.

Table.2. the physical inputs used in the production of organic and traditional tomato and their energy equivalences.

Inputs	Traditional tomato			Organic tomato		
	Amount	MJ	%	Amount	MJ	%
1-Biological control	-	-		50 kg	7356	19.5
Herbicides	-	-		-	-	
Fungicides	-	-		20kg	4320	
Insecticides	-	-		30 kg	3036	
1-Chemicals	71.6 kg	8422.6	18.7	-		
Herbicides	6 kg	1428		-		
Fungicides	3.1 kg	669.6		-		
Insecticides	62.5 kg	6325				
2.Human power	1200 h	2352	5.2	1056 h	2069.8	5.5
3-Machinery	25 h	1567.5	3.5	22 h	1379.4	3.7
4- Chemicals Fertilizer	217 kg	6656.8	14.8	-		
Nitrogen fertilizer	76 kg	5026.6		-		
Phosphate P_2O_5	45 kg	559.8		-		
Potassium K_2O	96 kg	1070.4		-		
5- compost	-	-		12 ton	3600	9.5
6- Seeds	0.150	0.150		0.120 kg	0.120	
7. Diesel fuel	505 L	24139	53.6	455 L	21749	57.6
8-Water	1880 m3	1917.6	4.3	1548 m3	1579	4.2
Total energy input		45056	100		37733	100
Output						
Yield	24000 kg	19200		22000 kg	17600	

Source: The survey carried out in Ismailia governorate 2017, and table 1

The components of the energy use pattern for organic tomatoproduction are shown in (Table 2) compost 12 ton, 455 L diesel fuel, 1548 m3 water, 50 kg Biological control, 1056 h human power, 22 h machinery, per fedden are used for the production of organic tomato in Ismailia governorate.

The average organic tomato output were found to be 22000 kg /fed. The energy equivalent of this is calculated as 17600 MJ/fed. Finally, the energy used in the production of organic tomato consists of 19.5 % Biological control, 5.5 % human power, 3.7 % machinery, 9.5% fertilizers, 57.6 % fuel (diesel) and 4.2 % water inputs. The highest energy input is provided by diesel fuel.

Energy Indices in organic and traditional tomato production

The energy ratio (energy use efficiency), energy productivity, specific energy, net energy gain and the distribution of inputs used in the production of organic and traditional tomato according to the direct, indirect, renewable and non-renewable energy groups, are given in (Table 3).

Table.3. Energy output–input ratio and type of energy forms for organic and traditional tomato production.

Items	Unit	Traditional tomato	%	Organic tomato	%
Energy ratio(energy use efficiency)	-	0.43		0.47	
Energy productivity	Kg/MJ	0.53		0.58	
Specific energy	MJ/kg	1.87		1.72	
Net energy	MJ/fed	-25856		-20133	
Direct energy a	MJ/fed	28409	63	25398	67
Indirect energy b	MJ/fed	16647	36	12335.5	33
Renewable energy c	MJ/fed	4269.7	9.5	7248.9	19
Non- renewable energy d	MJ/fed	40786	90.5	34084	90.3
Total energy input	MJ/fed	45056	100	37733	100
Energy output	MJ/fed	19200		17600	

Note: aIncludes human power, diesel, water;
b Includes chemical fertilizers, compost, chemicals,Biological control,seeds, machinery;
c Includes human power, compost, seeds, water;
d Includes diesel, Biological control,chemicals, chemical fertilizers,compost, machinery.

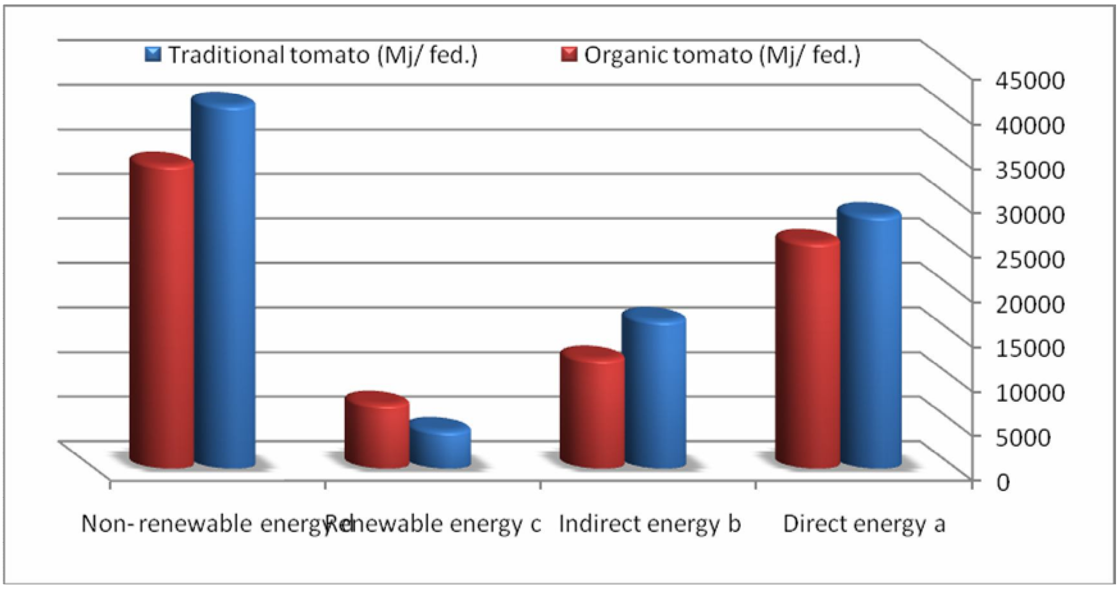
Source: Table 2

The ratio of renewable energy including the energies of human power, seeds, compost and water inputs, within the total energy in all productions is very low (Fig. 1). Renewable energy resources (diesel, hydroelectric, biomass, wind, ocean and geothermal energy) are inexhaustible and offer many environmental benefits over conventional energy sources. Each type of renewable energy also has its own special advantages that make it uniquely suited to certain applications (Miguez JL 2006).

The use of renewable energy offers a range of exceptional benefits, including: a decrease in external energy dependence; a boost to local and regional component manufacturing industries; promotion of regional engineering and consultancy services specializing in the use of renewable energy, decrease in impact of electricity production and transformation; increase in the level of services for the rural population; creation of employment, etc. Within the enterprises that were analyzed, the share of non-renewable energy for organic and traditional tomato production was 90.3%, 90.5%, respectively.

The energy ratio (energy use efficiency) in (Table 3) was calculated as 0.47 and 0.43 for organic tomato and traditional tomato production. The results of research indicated for The energy ratio (energy use efficiency) value of organic tomato in Ismailia governorate. The higher value of the energy ratio (energy use efficiency) for organic tomato production in this region can be explained by the efficiency of irrigation water and optimization of compost that affect in total energy consumption. The results of (Table 3) showed that the Energy use efficiency was low for traditional tomato production in Ismailia governorate. The reason of The energy ratio (energy use efficiency) in this research in comparison with other researches may be including: low yield, using high energy inputs consumption, etc. It is clear that the use of renewable energy in this region is very low, indicating that organic tomato and traditional tomato production depends mainly on oil fuels. By raising the crop yield, decreasing energy inputs consumption, use of renewable energy and optimization of energy consumption ratio can be increased.

Fig.1. Comparison between the share of energy forms for organic and traditional tomato productions



Source: The survey carried out in Ismailia governorate 2017

Energy productivity for organic and traditional tomato production was calculated by 0.58, 0.53, MJ/kg, respectively. The net energy of organic tomato and traditional tomato production was negative.

Studied energy efficiency, energy productivity, specific energy and net energy for organic tomato which amount of above indices were reported as 0.47, 0.58 kg/MJ, 1.72 MJ / kg and-20133 MJ/fed., respectively.

Greenhouse Gas Emission for Organic and Traditional tomato Productions

Table (4) shows the CO_2 emission for organic and traditional tomato Production in Ismailia governorate. Results of this table indicated that traditional tomato production is mostly depending on diesel fuel sources. Diesel fuel had the highest share (1393.8 kgCO_2eq/fed) followed by Insecticides (243.75 kg CO_2eq/fed) and Machinery (111.2925 kg CO_2eq/fed). Also organic tomato production is mostly depending on diesel fuel sources. Diesel fuel had the highest share (1255.8 kg CO_2eq/fed) followed by Insecticides (117 kg CO_2eq/fed) and Fungicides (102 kg CO_2eq/fed). As it can be seen in Table 4, the total Quantity of CO_2 emission for traditional tomato is more than total Quantity of CO_2emission for organic tomato by22.6%. Using ethanol and biodiesel as biofuel is essential in the 21st century to reduce the high GHG emissions. Field operations with minimum machinery use (especially tillage operation) and machinery production are needed to be considered to reduce the Quantity of CO_2.

Table 4:Quantity of greenhouse gas emission for organic and traditional tomato production

Inputs	unit	traditional tomato Quantity per unit area	organic tomato Quantity per unit area	GHG Coefficient (kg CO_2eq/ unit)	traditional tomato Quantity of GHG emission (kg CO_2eq/ fed)	organic tomato Quantity of GHG emission (kg CO_2eq/ fed)
Machinery	MJ/fed	1567.5	1379.4	0.071	111.2925	97.9374
Diesel fuel	L/fed	505	455	2.76	1393.8	1255.8
Chemicals Fertilizer	-	-	-	-		-
Nitrogen	Kg/fed	76	-	1.3	98.8	-
Phosphate P_2O_5	Kg/fed	45	-	0.2	9	-
Potassium K_2O	Kg/fed	96	-	0.2	19.2	-
1-Biological control	Kg/fed	-	-	-	-	-
Herbicides	Kg/fed	-	-	6.3	-	-
Fungicides	Kg/fed	-	20	5.1	-	102
Insecticides	Kg/fed	-	30	3.9	-	117
2-Chemical control	Kg/fed	-	-	-	-	-
Herbicides	Kg/fed	6	-	6.3	37.8	-
Fungicides	Kg/fed	3.1	-	5.1	15.81	-
Insecticides	Kg/fed	62.5	-	3.9	243.75	-
Total CO_2					1929.4525	1572.7374

Source: Table 2

Economic Indicators of Organic and Traditional tomato production

The total cost of production, gross income, net income and benefit-cost ratio (B/C ratio) were calculated and are given in (Table 5). Machinery with 8400 (L.E/fed) was the most cost in organic tomato production and followed by Opportunity cost of land with 6500(L.E/fed). The total cost for the production was 32970(L.E/fed) while the gross income was found to be 8800(L.E/fed). The net income and benefit–cost ratio (B/C)calculated55030 (L.E/fed) and1.7 respectively.

Because the government of Egypt doesn't give support to organic farms. Also show (Table 5) Machinery with 7200 (L.E/fed) was the higher cost in Traditional tomato production and followed by Opportunity cost of landwith5000(L.E/fed). The total cost for the production was 28200(L.E/fed) while the gross income was found to be 60000(L.E/fed).The net income and benefit–cost ratio calculated 31800 (L.E/fed) and 1.1 respectively.

Table 5:Estimated Economic Indicators of organic and traditional tomato production

Cost	Traditional tomato Value (L.E/fed)	Organic tomato Value (L.E/fed)
Labour cost	4870	5920
Opportunity cost of land	5000	6500
Machinery cost	7200	8400
Seed cost	4800	6000
Pesticide cost	2130	2550
Fertilizer cost	4200	3600
Total cost	28200	32970
Productivity	24 ton	22 ton
Price	2500(L.E/ton)	4000 (L.E/ton)
gross income	60000	88000
Net income (Benefit)	31800	55030
Benefit - cost ratio (B/C)	1.1 %	1.7%

Source: The survey carried out in Ismailia governorate 2017

Carbon trade

Carbon trade in Egypt:

Egypt signed the Kyoto Protocol on 15 March 1999, March and ratified as of 12 January (January) 2005. Egypt's efforts have gone into reducing greenhouse gas emissions and that the rationalization of consumption, and reduce leakage of transmission networks and distribution of oil and gas, and solid waste treatment with the use of treated wastewater. It is known that total greenhouse gas emissions in Egypt reached 2.6 M.tonCO_2 , 22 % of the energy sector, 21% of industry, and 15% of the agricultural sector, and 18% of the transport sector, and 9% of small industries, and 9% of traditional industries and 6% of Residuals.

- The main objectives of the carbon market are to reduce costs associated with emission reductions.
- Reducing emission would be economically feasible if the price of 20 to 30 $/ton.
- Both the public and private sectors should be involved in reducing CO_2 emissions. Promotes a shift towards low-carbon technology and information exchange, and promotes inter-linkages between different sciences.
- According to the IPCC report, the sale price of carbon tones should be 50 $ in 2020 to increase investment in advanced technology industries that reduce carbon footprint.
- According to the study, the production of organic tomato reduces emissions by 18% than traditional tomato equivalent78.6 $/fedThe area of tomatoes in Egypt in 2015 is about 187135 Fed(Economic Affairs Sector)if converted to organic agriculture provide around 14.7 million $/year.

Conclusions

Based on the present study the following conclusions are drawn

1) Greenhouse organic tomato production consumed a total energy of 37733 MJ/fed, which was mainly due to diesel fuel (57.6% of total energy). The input energy of total Biological control and compost have the secondary and tertiary share within the total energy inputs. Energy output was calculated as 17600 MJ/fed. Also

Greenhouse organic tomato production consumed a total energy of 45056 MJ/fed, which was mainly due to diesel fuel (53.6% of total energy). The input energy of total chemical and chemicals fertilizer have the secondary and tertiary share within the total energy inputs. Energy output was calculated as 19200 MJ/fed

2) The direct and indirect input energies were 67%and 33% of the total input energy, for organic tomato production respectively. Renewable energy sources among the inputs had a share of 19% of the total energy input, which was smaller than that of non-renewable resources. As well The direct and indirect input energies were 63%and 36% of the total input energy, for organic tomato production respectively. Renewable energy sources among the inputs had a share of 9.5% of the total energy input, which was smaller than that of non-renewable resources.
3) Total amount of CO_2 emission in organic tomato production was calculated as 1572.7374kg CO_2eq/fed. Diesel fuel had the highest share (57.6 %), Total amount of CO_2 emission in organic tomato production was calculated as 1929.4525 kg CO_2eq/fed. Diesel fuel had the highest share (53.6 %). It is possible to decrease greenhouse gas emission in agricultural production by reduction of non–renewable energy sources that create environmental problems. Therefore, policy makers should take the necessary measurements to ensure more environmental friendly energy use patterns in the Egyptian agriculture.
4) Reducing diesel fuel consumption and fertilizer usage, mainly nitrogen, is important for energy reduction. A saving in diesel fuel by improving tillage and hitting performance may be possible. Using direct and local marketing improves profitability for growers while reducing the amount of energy used to transport products.
5) The benefit-cost ratio (B/C)was found to be 1.7 for organic tomato, while the benefit- cost ratio (B/C) was found to be 1.1 for Traditional tomato, and thus invest in organic farming is the best in terms of profit.

Summary :

The aim of this study is to examine the energy use patterns and energy input–output analysisof organic and traditional tomato production. For this purpose, the survey was carried in 2017 by interviewing 30 Farmers in Ismailia governorate. Results indicated that a total input energy of 37733 and 45056 MJ/fed was consumed for organic tomato and traditional production respectively. Diesel fuel (with 57.6 %, 53.6 %) and biological control, chemical (with 19.5%, 18.7%) were amongst the highest input energies for organic and traditional tomato production. The energy productivity was estimated to be 0.58 kg /MJ, 0.53kg/MJ. The ratio of output energy to input energy was approximately 0.47, 0.43for organic and traditional tomato production respectively. Cost analysis revealed that total cost of production for fedden organic and traditional tomato production was around 32970, 28200 L.E /fed. Accordingly, the benefit-cost ratio (B/C) was estimated as 1.7, 1.1respectively. Results of greenhouse gas emission indicated that tomato production is mostly depended on diesel fuel sources. Diesel fuel had the highest share (1255.8 kgCO_2eq. /fed,1393.8 kgCO_2eq./fed)for organic and traditional tomato production respectively.

Keywords: Tomato, organic, energy productivity, economic Indicators.

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الآثار الاقتصادية للزراعة العضوية في الحد من انبعاثات غازات الاحتباس الحرارى

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الملخص

تعد الزراعة العضوية كنهج بديل لتعظيم أداء الموارد المتجددة وزيادة تدفق الغذاء والطاقة في النظم الزراعية البيئية. وتظهر تقييمات دورة الحياة أن الانبعاثات الناتجة عن نظم الانتاج التقليدية دائماً ما تكون أعلى من انبعاثات النظم العضوية، والسؤال هل تقلل الزراعة العضوية انبعاثات غازات الاحتباس الحرارى من الانتاج الزراعى. وما هو العائد من التوسع فى المساحات المزروعة بنظم الزراعة العضوية.

وتتمثل مشكلة الدراسة فى الإستعمال الخاطىء لمدخلات الإنتاج الزراعى من أسمدة ومبيدات كيماوية مما يؤدى إلى زيادة الإنبعاثات من غازات الإحتباس الحرارى.

يهدف البحث إلى توضيح أهمية الزراعة العضوية فى تخفيف أثار غازات الاحتباس الحرارى من خلال دراسة مقارنة لمحصول الطماطم تحت نظم الزراعة العضوية والتقليدية فى مصر، وكذلك دراسة أنماط استخدام الطاقة وتحليل المدخلات – المخرجات لإنتاج الطماطم العضوية والتقليدية. ولهذا الغرض قد تم عمل استمارة استبيان في عام ٢٠١٧ بإجراء مقابلات مع المزارعين لعينة من ٣٠ مزارع من مزارعى الطماطم العضوية والتقليدية في محافظة الإسماعيلية والتى تعتبر من المحافظات التى تنتشر بها الطماطم العضوية والتقليدية وبينت النتائج أن مجموع طاقة المدخلات بلغت نحو ٣٧٧٣٣ و ٤٥٠٥٦ ميجا جول/ فدان تماستهلاكها فى إنتاج الطماطم العضوية والتقليدية على التوالي. وقود الديزل يمثل نحو (٥٧,٦%،

٥٣,٦%) والمكافحة البيولوجية الكيميائية (١٩,٥ %، ١٨,٧%) من بين أعلى طاقات المدخلات لإنتاج الطماطم العضوية والتقليدية وقدرت إنتاجية الطاقة لتكون ٠,٥٨ كجم/ ميجا جول، ٠,٥٣ كجم/ميجا جول. وكانت نسبة المخرجات للمدخلات حوالي ٠,٤٧، ٠,٤٣ لإنتاج الطماطم العضوية والتقليدية على التوالي. وتبين من دراسة التكاليف الإنتاجية أن التكلفة الإجمالية لإنتاج الطماطم العضوية والتقليدية بلغت حوالي ٢٨٢٠٠ ، ٣٢٩٧٠ جنيه /فدان. وبناء على ذلك، قدرت نسبة المنافع للتكاليف بنحو١,٧ ، ١,١ على التوالي. وأشارت نتائج انبعاثات غازات الاحتباس الحراري إلى أن إنتاج الطماطم كلا النوعين يعتمد معظمها على مصادر وقود الديزل. كان أعلى حصة من وقود الديزل (١٢٥٥,٨ كجم CO_2/فدان، ١٣٩٣,٨كجم CO_2/فدان) للطماطم العضوية والتقليدية على التوالي.

وتوصى الدراسة بضرورة التحول إلى الزراعة العضوية، والإعتماد على مصادر الطاقة النظيفة مثل الطاقة الشمسية وطاقة الرياح والمياه للحد من إنبعاثات غازات الإحتباس الحراى.