

THE ROLE OF CROP PRODUCTION IN RECEIVING OF BIODISEL AS A NEW ENTREPRENEURIAL OPPORTUNITIES IN THE REPUBLIC OF MACEDONIA

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ABSTRACT

The role of plant production in the creation of new organic values is huge. Crop production, which is under the control of the people is placed in order to provide subsistence for the whole civilization and creating products who improve society and enable it's sustainability.

Today in the world is known through the 2 900 cultural plant species of which about 120-150 are grown for commercial purposes. In Republic of Macedonia the number of cultural plant species is much smaller. As raw material for the biofuel plant which will be a high energy value and opportunity for biorenewables serve a greater number of cultural plant species which in their seed contains a higher percentage of oil. Such are the oilseed crops have greatly serve to produce this energy, but also to use and revitalization of contaminated surfaces with heavy metals and radioactive elements.

Feasibility of producing and receiving a low cost of this energy is largely determined by the reduction of manufacturing costs of raw materials. All cultural oilseed plant species who have low production costs and provide low cost per unit of product is suitable for the production of basic raw material and can be used in the process of obtaining biodiesel.

The paper is presented briefly percentage of oil in different oil crops and are considered more dimensions of their production and opportunities for new entrepreneurial approach to this type of production and use of biodiesel in the Republic of Macedonia.

Keywords: plant, production, biodiesel, oil, seed

INTRODUCTION

Today, in many countries around the world, including the Republic of Macedonia, missing energy from renewable nature. Liquid fossil fuels are still primary generators of society, but they are, in the coming decades are expected to be missing and to their lack of exhaustion. With today's knowledge and advancement of science, technic and technology, is create real opportunity by producing bioenergy fuel to reduce a partly dependence of liquid fossil fuels, but also, to get the fuel will have lower emissions of CO₂ and other harmful substances in air and the environment, which indirectly contributes to reducing the risk of certain diseases.

The main aim for the production of biodiesel is that it fulfills the certain standards and the criteria which meet the needs and safety of consumers. The major advantages of biodiesel is reducing energy dependence of society from the existing energy who is renewable, protection of environmental and the opening of a new entrepreneurial opportunity to the business sector and agricultural production. Chemical, according Dimov et al. (2008), biodiesel is mono alkil ester of long chain fatty acids derived from renewable sources of fat.

The manufacturing process involves the use of vegetable oil as the main feedstock that by mixing (adding) of alcohol like methanol or ethanol and a catalyst NaOH₂ and further chemical reaction, that takes place under the influence of temperature and pressure to creates ester and glycerin.

The production of biodiesel from renewable sources as the main products of vegetable oils directly entering the mixing alcohol and catalyst are methyl and ethyl esters. The highest percentage of plant oils are found in seeds of oilseed crops, from which it may in a future, with strictly defined procedure to get this fuel, who with the success might to replace D-2 fuel.

SOME CHARACTERISTICS OF BIODISEL

Biodiesel is an alternative liquid fuel that is produced as a product of chemical modification of vegetable and animal fats by way of transesterification in which there is an exchange of glycerol with methanol. Is used to work on diesel engines as clean (independently) or in combination with mineral diesel. Conventional diesel engines without major difficulties using classic diesel which contains to 20% biodiesel. The new generation of diesel engines without major difficulties use the pure biodiesel.

He is largely degradable, non-toxic and non-flammable.

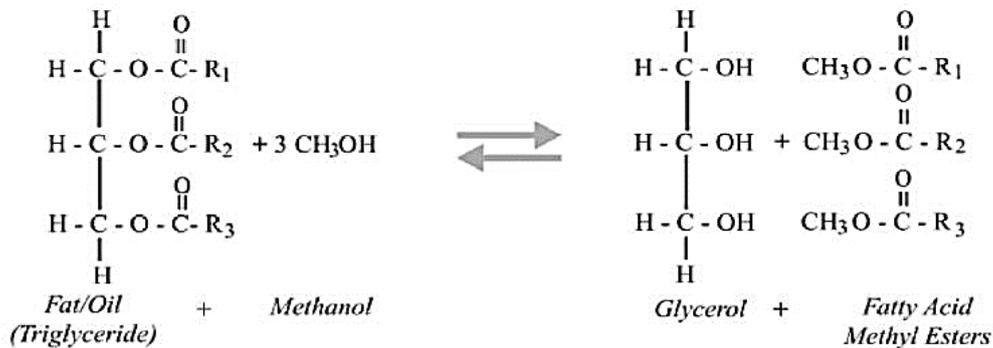
Because of the presence of oxygen into the structure almost completely burned and had little emission of CO₂ and other greenhouse gases compared with fossil liquid fuels.

Biodiesel has a lower energy value apart from normal mineral diesel. It burning very clean and to a large extent reminds us of a standard diesel. The content of sulfur in fuel is very small. Has a very good trait for lubrication. There had a fast and great power and it is very beneficial and is not a toxic for wildlife.

Biodiesel don't pollute the soil and water. It isn't easily flammable and hazardous material because the burning point is 110 °C.

This fuel is a renewable energy source because the dynamics and speed of spending send its renewal and re-manufacture is produced from plants which may be planted every year. For these reasons, it is recommended that his intensive use in all urban and suburban areas where there are a dense population, but also in areas where are organic farming.

Chemically, biodiesel is obtained in the process of trans-esterification:



However, should be a mentioned that besides the good characteristics of biodiesel, it can't completely replace mineral fuel.

He can pickle the materials in which are stored and kept. Biodiesel is not always economically expensive than diesel, but it depends on the culture from which it was produced raw materials, method of manufacture, etc. Biodiesel may last about 6 months. After the sixth to twelfth month he should to be a mixed and treated because it comes to his densification on low temperatures.

Because of the lower pH value compared of the classical diesel, biodiesel has a negative influences on certain plastic and rubber parts in the car.

Biodiesel has a negative impact on diesel pump which serves for supplying fuel to the diesel engine. This happens in older models of diesel engines which have not been certified for using biodiesel.

The main intention of producing biodiesel is to reduce the dependence of countries of the mineral diesel to preserve the environment and to raise the level of rural agricultural areas for the production of raw for biodiesel from the palette of plant species eligible for this purpose.

The volume of production of biofuels in 2009 worldwide is given in Table 1.

Table 1. World production of biofuels in 2009 year (Source: Biofuels Platform 2010, ENERS Energy Concept)

Country	Production in thousand tonne of oil equivalent (ktne)	Production in percent (%)
United States	22'014	43
Brazil	13'863	27
Germany	2'647	5
France	2'383	5
China	1'309	3
Argentina	1'080	2
Spain	1'003	2
Canada	833	2
Italy	694	1
Thailand	687	1
Belgium	444	1
Colombia	419	1
Poland	381	1
Austria	368	1
India	352	1
Others	3'292	6
TOTAL	51'769	100

As you might be seen from Table 1, the largest producer of biofuels is the United States (22,014 ktne) on which accounted 43% of total world production, then coming Brazil (13,863 ktne) with 27%, Germany (2647 ktne) with 5 %, France (2383 ktne) with 5%, etc.

PLANT SPECIES WHICH PROVIDE THE RAW MATERIAL FOR BIODISEL AND SOME OF THEIR CHARACTERISTICS

All plant species in the seeds contain a certain percentage of oil. It is the most concentrated kind of food supplies which is necessary for respiration, germination and growth of plants in the early periods of vegetation. However, for providing enough quantity of oil industry in crop production have a meaning only ones cultures which contain the highest amount of oil in the seed. These plant species are grouped and the called oil plants. Vegetable oil has wide application and its economic importance is a very great. First, it serves for human consumption, directly or as an integral part of different food products. The oil has a very high calorific value and, except for food, it is used in many industries.

Alternative fuels, including the biodiesel, can be produced from soybean oil (*Glycine hispida* L.), sunflower (*Helianthus annuus* L.), oilseed rape (*Brassica napus* var. *Oleifera* DC), oil-bearing of linen (*Linum usitatissimum* L. ssp. *Mediterraneum* Vav et all.), canola (*Brassica rapa*), peanuts (*Arachis hypogea* L.), sesame (*Sesamum indicum* L.), oil-bearing poppy (*Papaver somniferum* L.), cotton (*Gossypium* species L.), corn (*Zea mays*), the saffron (*Carthamus tinctorius*), olive (*Olea europaea* L.), oil palm (*Elaeis guineensis*), coconut palm (*Cocos nucifera*), castor oil (*Ricinus communis* L.), jatropa (*Jatropha curcas*) and others plant species.

According to Dimov et al. (2008), the economics of biodiesel production is dictated by raw material which should have a lower price, and therefore of this the most suitable crops is canola and other oilseed rape. Due the increased production and use of biodiesel in the total consumption of

liquid fuels, in recent years is increased the production of cultural plant species of which are getting a raw material for biodiesel.

Advantages in growing any of these crops comes up if it has easy growth and development of the poor and exhausted soils, the ability of the root system to reach up water deep in the soil, or be resistant to drought conditions.

All those cultures who don't require use of intensive agro technics and all of those who will provide safe production of cheap raw material, will have an advantage in the production of biodiesel.

Table 2. Some characteristics on biodiesel plants

Plants	Oil content (%)	Kg oil /ha	Yield per hectar
<i>Glycine hispida L.</i>	20-33	338 - 702	1 300 - 2 700
<i>Helianthus annuus L.</i>	30-45	456 - 1 064	1 200 - 2 800
<i>Brassica napus var. oleifera D.C.</i>	40-49	494 - 720	1 100 - 1 600
<i>Linum usitatissimum L.</i>	32-47	360 - 560	900 - 1 400
<i>Brassica rapa</i>	35-42	456 - 608	1 200 - 1 800
<i>Arachis hypogea L.</i>	50-55	624 - 1 404	1 200 - 2 700
<i>Sesamum indicum L.</i>	52-63	159 - 228	280 - 400
<i>Papaver somniferum L.</i>	55-60	348 - 638	600 - 1 100
<i>Gossypium species L.</i>	17-19	99 - 155	550 - 860
<i>Zea mays L.</i>	3,3-15,9	250 - 500	2 500 - 5 500
<i>Carthamus tinctorius</i>	25-34	150 - 300	500 - 1 000

Soybean is a legumes crop which a largely complements and also a resolves the problem of the lack of vegetable oils. With regard to natural growing conditions she is considered as more resistant to high and low temperatures of corn. In Republic of Macedonia, soybeen still cultivated in insignificant small surfaces. It needs resolved with import from the global market.

Sunflower is one of the most important oilseed crops. From it receives one of the highest quality oils for human consumption. Sunflower can get a fairly high and stable yields. Sunflower can be grown in all of regions of the Republic of Macedonia. It is cultivated on warmer and sunny regions. With regard to need for water, this plants is much nice submits a drought, because develop a powerful and strong root system. The collection of sunflower need be made earlier, before the brown maturity of plants, because then oil in seed is sufficiently high and humidity is around 11%, which suited for collecting machine.

Rape seed contains 40-49% oil and it is used for human consumption and for technical uses. One reason for the lack of interest from manufacturers for the propagation is their instability on yield, which is due to the sensitivity of the frost in periods on their growing, a relatively large number of pests who attack and easy dropout of seed in the mature condition. Retrieving need be done early in the morning, in a shorter interval because maturation of seeds tactics involved very quickly.

Poppy seed is very rich in oil (50-60%). Because oilseed poppy is grown in the north areas, for Republic of Macedonia it has the importance that as crop while completely avoids the summer droughts with his early ripening.

But in spite of all these advantages who have this culture, today, in Republic of Macedonia it's cultivated on marginally small areas. Retrieving is mechanical with a combine on dry and sunny weather, when seed is completely dry. Poppy seed can be kept on 10% humidity, clean and very well-ventilated rooms.

Sesame contains the highest percentage of oil in the seed compared with all of other oil plants. Depending on the variety, environmental conditions and applied agro technics, contains about 52-63% oil in the seed. Short vegetation allows be cultivated as a second crop in the same surface and to get a yield of two crops in year.

In the Republic of Macedonia, can be grown in areas where prevailing Mediterranean climate or in hot, sunny and moderate wet areas, and the initial periods of growth and development is in the soil temperature of 20-21 °C. The major areas is collected mechanized with combine, in periods of seeds maturing, especially the varieties of sesame are resistant to cracking.

Peanuts seeking a lot of heat, light, moisture and fertile soil. Ideal conditions for production are in the south-eastern areas of Macedonia. It is best prospers in areas with 500-600 mm rainfall during the vegetation. Dry conditions haven't tolerated, especially in drought-sensitive periods of flowering and formation of seeds.

The seeds of cotton are getting 17-19% oil, which can be used for technical uses (production of soaps, glycerin, biodiesel), and if it be made refining, then can be used for dining. Cotton is plant who want a lot of light and is resistant to drought, because had a deep and powerful root system.

Oilseed flax grows into something warmer and drier areas with a greater number of sunny days. In Macedonia, it can be cultivated in the plain areas. Oilseed flax is harvested at ripeness with special machines. For storage of seeds, humidity doesn't have be a greater than the 11-13%.

POSSIBILITIES AND BIODISEL PRODUCTION OF REPUBLIC OF MACEDONIA

From the aspect of reliability of the energy supply, Republic of Macedonia belongs to the group of highly import dependent countries. The percentage share of imports in the consumption of primary energy in 2010 amounted to 44.0%. To ensure energy security, according to the Strategy for development of the energy sector in the country, is planned to make a greater diversification of energy resources by type, sources and suppliers. In this sense, envisage an active role of the regional energy market and reduce the high dependence on energy from Macedonia, maximum possible utilization of domestic resources. (Source: MANU 2012).

Macedonia is characterized by excellent soil and climatic characteristics and it had about 545 514 hectares arable land. Good deal from these natural resources with favorable climate can be put in function for the production of biofuel.

In Macedonian market exists offer of biodiesel, but not as pure biodiesel, but rather as eco-diesel, which a participation of biodiesel about 20% in classic diesel.

The first biodiesel factory in the country was opened in 2007 by a private company Makpetrol with a capacity of 30 thousand tons per year. The production of biodiesel fuel in the refinery largely used unrefined oil seed rape (*Brassica napus* var. *Oleifera* DC) which unfortunately, is still procures by imports.

Makpetrol introduce a biodiesel fuel on the Macedonian market on liquid fuels for transport, with a vision to establish a new bioenergy platform with the adopted standards in relating to the manufacture, distribution and quality of biofuels. Scheduled also a construction of several new factories for the production of biodiesel fuel in the country, which are planning to performed the extraction of oil from sunflower (*Helianthus annuus* L.), oilseed rape (*Brassica napus* var. *Oleifera* DC) and soybean (*Glycine hispida* L.). A future aim of the Republic of Macedonia is as soon as to introduction and application a new technologies for obtaining biofuel from a second generation, which are a high level by development.

In the Republic of Macedonia, according a State Statistical Office of the Republic of Macedonia, in 2011 year is cultivated only maize and sunflower crops of which are eligible for the production of raw material for biodiesel.

Table 3. Production of suitable crops for biodiesel by the State Statistical Office of the Republic of Macedonia for 2011 year

Crops	Sown area / ha	Production in tons	National average yield
maize	29 390	126 096	4 294
sunflower	5 715	8 497	1494
total	35 105	134 593	2894

They crops were sown with a total area of 35 105 ha and were produced 134 593 tons of seed.

CONCLUSIONS

All of the work presented, we can conclude the following:

In most of countries around the world, including the Republic of Macedonia, missing energy from renewable nature.

Biodiesel is alternative liquid fuel and it's produced of chemical modification of vegetable and animal fats by way of transesterification.

The major advantages of biodiesel is reducing energy dependence of society from the existing energy who is renewable, protection of environmental and the opening of a new entrepreneurial opportunity to the business sector and agricultural production.

From the aspect of reliability of the energy supply, Republic of Macedonia belongs to the group of highly import dependent countries.

The largest producer of biofuels is the United States (22,014 ktne) which accounts for 43% of total world production.

Alternative fuels, including and biodiesel, can be produced from a large number of oil crops and oil plants which contain a large percentage of oil in him seeds.

Because of the increased production and use of biodiesel in the total consumption of liquid fuels, in recent years around the world we have increasing production of cultural plant species of which are getting a raw material for biodiesel.

The Republic of Macedonia has excellent soil and climatic characteristics for the production of sufficient quantities of raw material which could be used to produce biofuel.

According a State Statistical Office of the Republic of Macedonia, in 2011 year is cultivated only maize and sunflower crops of suitable raw material for biodiesel.

At most, the production of maize and sunflower are used for feeding in animal husbandry and processed products for human consumption.

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