

Workgroup C

Implementing organic food production in the DRB

Organic farming is an agricultural system that seeks to provide you, the consumer, with fresh, tasty and authentic food while respecting natural life-cycle systems
(EU commission – Agriculture and rural development)

ABSTRACT

The aim of the project is a more sustainable agriculture and the re-ruralisation of remote mountainous regions in the Danube River Basin through the strengthening and establishment of organic farms in selected less developed mountainous regions, and through educating the demographically young population of the Danube area to organic farming methods and practices and to the ecological relevance of quality farming. Organic food production implements traditional and indigenous knowledge, fosters a more eco-friendly use of soil and water resources, and allows farmers in market-marginalized areas to rely on local resources and food distribution systems, therefore addressing the challenges of demographic change in mountainous regions by creating local networks and strengthening marketing activities in the selected regions.

KEYWORDS

re-ruralisation
mountainous regions
organic farming
market-marginalized
demographic change
ancient crops

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1. INTRODUCTION

Our overall objective is a more sustainable agriculture in the Danube River Basin. In order to achieve this goal we are proposing to strengthen and establish organic farms in selected less developed mountainous regions in the Danube River Basin. In doing so we will address the Horizon 2020 challenge of food security. Furthermore this project will address the challenge of demographic change in mountainous regions by creating local networks and strengthening marketing activities in the selected regions. Intermediate results of our project will be less polluted soil and water and re-ruralisation of remote mountainous regions.

2. MODERN AGRICULTURE AND ITS DISCONTENTS

A SHORT OVERVIEW OF THE ORIGINS AND SOCIO-ENVIRONMENTAL PROBLEMS OF MODERN FARMING

An overview of the origin of modern agriculture and its problems must begin with the Fertile Crescent and the phenomenon that Gordon Childe named the Neolithic revolution. At the same time, the solution of a contemporary “uneasiness in agriculture” lies in the explanation of the agricultural socio-genesis and the understanding of natural, ecological and social logic of ancient agricultural practices.

First of all, it is important to understand that the emergence of agriculture was not a sudden “revelation”, but a time-consuming process that occurred independently in several areas of the world. It is also crucial not to think that hunting and gathering, the subsistence practice that human animals used for hundreds of thousands of years, were inefficient and ineffective. It is wrong to suppose that the hunter-gatherers life was short and hard, and that the emergence of agriculture was the solution for existence of an ancient man. Farmers spend several hours a day at work, and until a few centuries ago (or even a century), their life expectancy was longer than the life span of hunter-gatherers.

Therefore, agriculture in certain regions of the world appeared gradually, from a combination of necessity and favourable conditions for its development. The earliest evidence of domesticated plants is found in certain areas of today's Palestine, Iraq, and Iran, during the period between 9,000 and 7,000 BC. The main

crops that were domesticated were the ancient varieties of wheat, barley and rye. Crops such as emmer and einkorn wheat do not appear to have become domesticated until well into the Neolithic and ancient rice took 3000 years to become domesticated. In other words, it was not until after 9500 BC that the eight so-called founder crops of agriculture appear: first emmer and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax. The title "inventors of agriculture" usually goes to the Sumerians, starting c. 5500 BC.

The first explanation of an agriculture socio-genesis concerned the assumptions about food production at the oases stimulated by draughts and lack of food reserves. Later ideas add demographic factors into the picture, such as the factors appearing due to the transition towards a productive economy, along with many other socio-ecological factors. Today, most theorists interpret the origins of agriculture as an inevitable response to the crisis in traditional hunter-gatherer economy and the necessity of providing a system of survival in the new ecological situation. It is a situation that is primarily characterized by imbalance between natural resources and human needs. These are the socio-historical messages that are relevant for the challenges in a modern ecological context.

An interesting example concerning these issues comes from the classical antiquity. Roman agriculture built from techniques pioneered by the Sumerians, transmitted to them by subsequent cultures, with a specific emphasis on the cultivation of crops for trade and export. Romans laid the groundwork for the manorial economic system, involving serfdom, which flourished in the Middle Ages. The farm sizes in Rome can be divided into three categories: small farms were from 18-88 iugera (one iugerum is equal to about 0.65 acre), medium-sized farms from 80-500 iugera (singular iugerum), and large estates (called latifundia) that were over 500 iugera.

The Romans had four systems of farm management: direct work by owner and his family; slaves doing work under supervision of slave managers; tenant farming or sharecropping in which the owner and a tenant divide up a farm's produce; and situations in which a farm was leased to a tenant. There was a great deal of commerce between the provinces of the empire, all the regions of the empire became interdependent with one another, some provinces specialized in the production of grain, others in wine and others in olive oil, depending on the soil type.

In the Middle Ages, European agriculture underwent numerous significant changes, such as the improvement of tools (scythe, plough), a new system of crop rotation, an increased usage of advanced ploughs, usage of horses and oxen etc. In this period, much of Europe had low population densities, which suited extensive farming techniques. These were crucial steps towards

agricultural modernization, although the socio-cultural structure around it remained traditional.

Between the 16th and the 19th century, mechanization gradually became more sophisticated. This resulted in unprecedented population growths and ultimately led to Industrial Revolution. Also, the socio-genesis of agriculture was closely tied to the processes of European exploration and colonization in an ever-more globalized world. The agricultural patterns of the world underwent dramatic changes in a process labelled as the Columbian Exchange (exchange of plants and animals between the Old World and the New World).

What were the socio-environmental problems concerning these massive historical events? The agricultural revolution(s) proved to be major turning points in history. First of all, the world experienced its first stable settlements or sedentary communities made by humans. Then, there was a dramatic increase in human populations, which led to a rising demand for different goods and services. In other words, this wide-scale transition of many human cultures from a lifestyle of hunting and gathering to one of agriculture and settlement transformed the small and mobile groups (that had hitherto dominated human history) into sedentary societies living in built-up villages and towns. The food surpluses provided the basis for complex labour diversification, trading economy, administrations and political structures, as well as art, architecture and culture. And, above all, these changes radically modified natural and social environments of humans.

It is often argued and/or thought that agriculture gave humans more control over their food supply, but this was disputed by the findings that nutritional standards of Neolithic populations were generally inferior to hunter-gatherers. Furthermore, the life expectancy of agricultural populations might have been shorter than the hunter-gatherers, probably due to the diseases generated from living in close encounter with domesticated animals. For example, not until the 20th century did the average human height come back to the pre-agricultural levels. Also, it shouldn't be forgotten that food production led to the emergence of powerful social elites that were not engaged in agriculture, but nevertheless dominated their respective societies.

Societies collapse due to the environmental component, which is a too-often and usually neglected scenario in history. In other words, environmental fragility is a crucial input element of societies' (in)stability, while the outputs could be survival or collapse. The main problem concerning this is the failure to adapt to the pressing environmental issues, such as deforestation, soil problems, water management problems, overhunting, overfishing, and effects of introduced species on native species, overpopulation and increased per-capita impact of people.

3. AN OVERVIEW OF POTENTIAL SOLUTION(S)

WITH REFERENCE TO THE SOCIO-POLITICAL POINT OF VIEW

Increasing agricultural production and decreasing agricultural workers, how it happened and how not allow this situation repeat more: an educational approach.

After the Industrial revolution and with the use of more and more sophisticated and improved mechanical and chemical technology and the use of new forms of energy people of Europe solved the problem of feed but modified completely the way of agricultural production, agricultural products, landscapes and above all the philosophy on which the relationship between humans and the environment was based. Agriculture has been transformed from the principal opportunity of livelihood into a business. But soil and agriculture are living things and so they are not able to sustain in extreme business and exploitation logic.

A problem observed is the increase of agricultural production but the systematic and so far irreversible process of decrease in the number of people employed in agriculture, and this is connected to rapid urbanization, ghost villages and the cause of a lot of former farmers unemployed. Mechanical devices and tools replaced the workers. Agricultural politics were just attracted by profit forgetting the ancient smart attention to manage agricultural resources.

Since some years we can observe a sort of reversibility of this phenomena. It is very important to educate new generations and in particular new generations of agricultural workers to have a new relationship with the environment and with the managing of crops. In this way, we will create, with the fundamental help of institutions, a new ecological sensibility. Agricultural workers will produce with a "quality" and not "quantity" mentality. To do this we first have to change mentality suggesting a modern, but in the same time traditional mentality; not only in the agriculture professional schools but just in schools we have to reinstate two fundamental concepts: sustainable production in connection with sustainable consumption. Education is as important as politics because every agricultural worker has to feel the agricultural soil as a living entity to protect and manage. We want to create awareness of a sustainable agriculture and try to do all what is possible to reduce wastes and pollution. In the future agriculture will be a resource compatible with the environmental needs. Emerging countries in the Danube region will serve as a new European think tank.

The Danube River Basin is connecting important European Union new entry counties with others outside the economic community. A lot of them hold

developing economies with huge and not still quantified growing possibilities. We have to plan, promote, boost with economic incentives the integration and collaborations among countries, planning permanent connections and joining the international platform. This pilot project pattern institution could have the possibility to offer an incentive for the stakeholder countries.

New entered countries in the Balkans and in Eastern Europe have a lot of very interesting demographic and economic parameters very important in agriculture. Co-operation is a possibility and above all an opportunity. The economics in these countries are in a new initial phase but the very important consideration is that their economics parameters are often growing unlike the worn out economics of west European countries.

On average they have a young population, so they are rich of people to educate in an ecologic way. The objective could be not just educate new generations but also become the integration an economic benefit changing the situation a lot of them are still taking out of the European decisions maker circuit; that would also increase the sustainable consumption. Danube community countries are open minded and ready to experiment new sustainable politics and international projects, and also to incentive know how interchange. A great "green" container of resources not still developed at top must become in Europe an example of green economy and ecological progress.

4. ORGANIC FOOD PRODUCTION

KEY CONCEPTS AND METHODS

Production of organic food is an approach that involves the production of food in a natural and traditional way, which is in harmony with nature, without using pesticides and chemical means. Organic food is food produced in a way that complies with organic standards set by national governments and international organizations.¹

Organic agriculture defines a farm as an integrated system of soil, plants, animals and humans and is responsible for the balance of all these elements.²

1 <http://www.epa.gov/agriculture/torg.html#Organic> Production and Handling Standards (17/04/2013)

2 <http://www.zps.si/hrana-in-pijaca/oznacevanje-zivil/ekoloska-zivila-4.html#O> ekološkem kmetijstvu in pridelkih (18/04/2013)

Organic farming takes the best of farming methods used in the past and combines them with modern scientific knowledge. It provides long-term benefits to people and the environment.

The goals of organic farming are the maintenance of soil fertility, closed nutrient cycling, protection of natural living resources, minimal environmental impact, the active protection of the environment and biodiversity. Sustainable use of energy and raw materials and also to ensure employment in agriculture.³

There are several methods which can be used to improve the quality of the soil and achieve higher productivity, even on less suitable areas for agricultural use. These methods are permaculture, which includes crop rotation and mulching, biodynamic methods and use of organic fertilizers, like green manures and compost.

Permaculture is a holistic approach to landscape design and human culture. It is an attempt to integrate several disciplines, including biology, ecology, geography, agriculture, architecture, appropriate technology, gardening and community building.⁴

Soil fertility is maintained with the use of organic fertilizers (manure, compost and green manures). Compost is organic matter (plant and animal residues) which has been rotted down by the action of bacteria and other organisms, over a period of time. Materials such as leaves, fruit skins and animal manures can be used to make compost. Compost is cheap, easy to make and is a very effective material that can be added to the soil, to improve soil and crop quality.⁵

Green manures, often known as cover crops, are plants which are grown to improve the structure, organic matter content and nutrient content of the soil. They are a cheap alternative to artificial fertilisers and can be used to complement animal manures. They increase and recycle plant nutrients and organic matter, improve soil fertility, soil structure, the ability of the soil to hold water, control soil erosion, prevent weed growth and stop the process of nutrients being washed out of the soil, for example, when the ground is not used between main crops.

Soil fertility is also maintained with the right soil cultivation at the right time, crop rotation and mulching on the soil surface. Mulching means covering the ground with a layer of loose material such as compost, manure, straw, dry grass, leaves or crop residues. Mulches have several effects on the soil which help to improve plant growth. These effects are decreasing water loss due to

3 http://www.zps.si/hrana-in-pijaca/oznacevanje-zivil/ekoloska-zivila-4.html#O_ekološkem_kmetijstvu_in_pridelkih (18/04/2013)

4 <http://www.permaculture.net/about/definitions.html> (17/04/2013)

5 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

evaporation, reducing weed growth by reducing the amount of light reaching the soil, preventing soil erosion, increasing the number of micro-organisms in the top soil, adding nutrients to the soil and improving soil structure and adding organic matter to the soil.⁶

The organic farmer must cultivate the soil at the right time and in the right ways to provide the best living conditions for the soil life and plant roots. Growing the same crops in the same site year after year reduces soil fertility and can encourage pests, diseases and weeds in the soil. Crops should be moved to a different area of land each year, and not returned to the original site for several years. For vegetables a 3 to 4 year rotation is usually recommended as a minimum.⁷ Crop rotation also helps a variety of natural predators to survive on the farm by providing diverse habitats and sources of food for them.

The quality of the stock of meat, milk and eggs they are trying to achieve by high-quality animal feed and compulsory free-range outside the barn. Horses and cattle used to be a basic farm feature that provided labour for hauling and ploughing, and also fertility, which is important for the self-regeneration function of farms. Recycling of manure and fuel in the form of food for farmers and other animals is important for self-sufficiency and also for sale of surpluses. Organic crops contain much less components, which reduce the amount of food (pesticides, nitrates), products have better taste and contain several ingredients that are good for human health. To control pests, diseases and weeds we have to make a careful planning and crop choice, implement the use of resistant crops and encourage useful predators that eat pests. Each crop and crop variety has its own specific needs. In some places it will grow well and others it will not. Crops are affected by soil type, rainfall, altitude, temperature, the type and amount of nutrients required and the amount of water needed. These factors affect how a crop grows and yields. If a crop is grown in a climate to which it is not suited, it is likely to produce low yields and be more susceptible to pest and diseases. Varieties should be selected to suit local climatic conditions. There is also very important companion planting with other crops that pests will avoid, such as onion or garlic.⁸

Genetic diversity is important when we are talking about the selection of appropriate crops and seeds. Ancient crops grown by farmers contain greater genetic diversity than modern bred crops. Ancient varieties have been selected over many centuries to meet the requirements of farmers in a specific region. Although many are being replaced by modern varieties, seeds are often still saved locally.

6 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

7 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

8 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

Although some modern varieties may be very resistant to specific pests and diseases they are often less suited to local conditions than ancient varieties which have higher natural resistance.⁹ By implementing organic agriculture we try to minimise all forms of pollution that may result from agricultural practices.

Methods. In order to explore the area on which the project will be applied different steps need to be conducted (Table 1). Geological, geomorphological, pedological, meteorological, hydrological, biological (biodiversity) research needs to be done, as those are the natural foundations for farming. That includes literature data (maps and papers) and direct field observation. Remote sensing is very useful for that purpose as well as for estimations of soil parameters with different remote sensing sensors and techniques for finer scale analysis (Zribi, Baghdadi & Nolin 2011).

Biological, chemical and physical properties of soil and ground water will be analysed to determine its present condition in the sense of nutrient contents as well as possible existing pollutants (C, N, P, K, Mg, Ca, pH, EC, faeces, heavy metals, pesticides and herbicides). According to soil and water condition (nutrient depleted or not, polluted or not) different approaches should be applied, e.g. nitrogen fixating bacteria and bioremediation to remove pollutants. Experts that should be consulted are stated in Table1.

Another important aspect of organic farming is the implementation of traditional and indigenous knowledge. For that purpose different approaches will be applied: ethnological, historical and archaeobotanical literature and sources will be investigated. If those data do not exist or are scarce, this will be analysed by coring or/and excavating of test pits. This could provide us precious data about ancient plants that were once planted in this area and are most adapted to specific soil types and region/climate, and because of that have resistance to pests and give good yields on poor soils. Such are einkorn (*Triticum monococcum*) and emmer (*Triticum dicoccon*) that were the predominant cereals during the Neolithic and today are relict crops in mountainous areas in Europe (Hajnalova & Dreslerova 2010). In the Carpathian (Slovakia, Ukraine, Romania) and Dinaric region (Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Kosovo region) einkorn was grown until 2.WW (Hajnalova & Dreslerova 2010), so this areas could be suitable for reintroduction of this ancient crop.¹⁰

9 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

10 <http://www.gospodarski.hr/Publication/2005/21/pirevi-pogodni-za-ekoloku-proizvodnju/6876#.UXJh-hzlgU8> (19.4.2013)

TABLE 1		
OBJECT	EXPERTS	METHODS
Landscape: geology precipitation insolation temperature land processes (erosion) biodiversity nature conservation	geologist geomorphologist biologist	literature research geological maps meteorological data remote sensing
Soil: nutrients pollutants biodiversity	agronomist biotechnologist chemist biologist toxicologist	biological, toxicological, chemical and physical properties remote sensing bioremediation
Water: nutrients pollutants biodiversity	hydrologist chemist biologist toxicologist	biological, toxicological, chemical and physical properties remote sensing bioremediation
Ethnology	ethnologist architect	literature research interviews with local people
Archaeobotany	archaeobotanist (+ radiocarbon lab and ancient DNA lab)	literature research excavation of test pits and/ or coring radiocarbon dating ancient DNA
Monitoring: pollutants and nutrients in soil and water agricultural yield biodiversity	GIS expert	GIS program

5. SOCIO-ECOLOGICAL ANALYSES

THE METABOLISM ISSUE

In this task a social-ecological analysis of the selected organic farms will be done. Social Ecology deals with questions of human-nature interaction. Colo-

nization of natural processes is one of the major concepts of social ecology. This concept refers to socio-economic intervention into natural processes in order to transform and utilize them for their purposes (Fischer-Kowalski & Weisz 1999). For this purpose humans have to invest time and energy. Agricultural practices are the prime colonizing intervention into natural processes. Humans intervene into nutrient and water cycles in order to produce food, fibre and other biomass based materials.

Another concept of social ecology, social metabolism, refers to the related resource flows of societies. Societies extract and use natural resources in order to build up and maintain their biophysical compartments (humans, infrastructure, and livestock) on the one hand side and on the other hand in using these materials they produce waste and emissions (Fischer-Kowalski & Weisz 1999). The material and energy flow accounting framework (Haberl et al. 2004) can be applied as a tool for analysing these social-metabolic flows. Socio-metabolic flows can be analysed on different scales: for the totality of humankind, on a national wide level, for a city, a region or even on the scale of a farm.

This part of the project will analyse energy and nutrient flows and time use on the selected farms using the material and energy flow accounting framework (Haberl et al. 2004, for the application on the local level see: Singh et al. 2010). Respective data will be collected and analysed on a yearly basis. We will calculate the energy return on energy investment (EROI) (Cleveland 2008) for each farm, we will establish nutrient balances (Krausmann 2004) for each farm and gather information on time use (see Singh et al. 2010) on each selected farm. Data will be compared among the selected farms and with farms using conventional production methods based on a literature review. The following two hypotheses will be tested: organic farms have a higher EROI, than conventional farms. Organic farming needs more investment of production time of the farmers. The nutrient balance will be a tool for monitoring potential nutrient shortages.

The comparison of farms will allow detecting factors contributing to an efficient use of energy, nutrients and time.

Results of this part of the project will contribute to the understanding of metabolic flows on a very local level. It will provide empirical data from several case sites which will be further useful in the analyses of socio-ecological farming systems. On the sites the socio-ecological analyses will serve as a monitoring tool.

6. REGIONAL ORGANIC FOOD PRODUCTION

THE ECONOMICAL ASPECTS

In market-marginalized areas, organic farmers can increase food production by managing local resources without having to rely on external inputs or food distribution systems over which they have little control or access. Organic farms grow a variety of crops and livestock in order to optimize competition for nutrients and space between species: this results in less chance of low production or yield failure in all of these simultaneously. In rain-fed systems, organic agriculture has demonstrated to outperform conventional agricultural systems under environmental stress conditions (FAO, 2013).

Investment and yields. The performance of organic agriculture on production depends on the previous agricultural management system. In *industrial countries*, organic systems decrease yields; the range depends on the intensity of external input use before conversion, while in *traditional rain-fed agriculture* (with low-input external inputs), organic agriculture has the potential to increase yields. In fact, many multiple cropping systems, such as those developed by small holders and subsistence farmers, show higher yields in terms of total harvest per unit area (RodaleInstitute.org). These yield advantages have been attributed to more efficient use of nutrients, water and light and a combination of other factors such as the introduction of new regenerative elements into the farm and fewer losses to pests and diseases. Farmers are finding that they can cut their inputs of costly pesticides and fertilisers substantially, varying from 20-80%, and be financially better off. Yields do fall to begin with (by 10-15% typically), but there is compelling evidence that they soon rise and go on increasing (Pretty, 1998). Cornell University conducted a 22 year-long Rodale Field Study (RodaleInstitute.org) where it was found that organic farming: (1) improved soil allowed the organic land to generate yields equal to or greater than the conventional crops after 5 years; (2) conventional crops collapsed during drought years; (3) organic crops fluctuated only slightly during drought years, due to greater water holding capacity in the enriched soil; (4) organic crops used 30% less fossil energy inputs than the conventional crops (Pimentel et al., 2005). Studies which compared the income of organic farms with conventional farms have found that the net incomes are similar, with best practice organic systems having higher net incomes by increasing yields, total on-farm productivity is higher and higher on-farm yields (UNEP-UNCTAD, 2008;

Cacek, 1986; Wynen, 2006). It can be concluded that increased yields on organic farms are more likely to be achieved if the departure point is a traditional system, even if it is degraded (FAO, 2013).

Returns. Organic systems produce more corn than the conventional system in drought years. The average corn yields during the drought years range from 28% to 34% higher in organic systems (Pimentel, 2005). The researchers attributed the higher yields in the dry years to the ability of the soils on organic farms to better absorb rainfall. This is due to the higher levels of organic carbon in those soils, which makes them more friable and better able to store and capture rain water which can then be used for crops (La Salle and Hepperly, 2008).

Quality – implementation of ISO 22000. When it comes about organic products, the ISO you need to find more about is 22000. This new standard is common in the food supply chain, in crop production, in processing and delivery, actually in everything related to food. All those that adopt the ISO 22000 standard benefit of a unique global standard, identical procedure required worldwide, better communication with business partners and clients, the possibility of continuous improvement and a clearly auditable standard.

Marketing. Organic foods are promoted as being: safer, better-tasting, environmentally friendly, farmer friendly. Marketing strategy will be focused on the following areas: (1) publicity through word of mouth, (2) interpersonal contacts for feedback about products, (3) work with grassroots (associations, community clubs, schools) for farm visits, (4) use interest of mass media to publish on new and trendy issues, (5) develop a strong brand (logo) for communicating the products and the company, (6) focus will be put on both local and export market (export market as money generator for local market development).

Networking aspects. Local organic farm producers will have to connect with other players in the region such as input producers (seed, animal food, etc.) and distribution channels/points of sale (markets, restaurants, local government and educational institutions). For achieving collaboration among local organic food stakeholders the following actions will need to be conducted: (1) implementation of supply chain management, (2) direct business relations, (3) sales plans in line with production, (3) develop advance purchasing scheme, (4) provide training to producers, (5) technological development important to improve efficiency (lower cost of production).

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