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Spring 2022

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GLOBAL IMPORTANCE AND APPRECIATION OF GRASSLAND BASED ANIMAL HUSBANDRY

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ABSTRACT

Aim of this study was to briefly summarize scientific results to help in clarifying recent role of animal husbandry - especially that of grassland based livestock production – regarding aspects of sustainable development, healthy nutrition and environment protection; in order to promote national animal breeding sector.

Wild living creatures, even without presence of farm animals, influence and control their environment through their metabolites. Circumstances under which cellulose is degraded by appropriate basically determine its beneficial value both from eocological and human aspects. Independently from the way by which degradation of organic materials happens; at the end of the process in case of carbon CO_2 and methan, while in case of nitrogen nitrogen-oxides and N_2 are produced. How and what materials are utilized in the meantime greatly depends on humans.

Grasslands are among the second most important land eocosystems. More than 38% of the world population live on grasslands, and remerkable part of them belong to the poorest population.

Unprofessional use of grasslands damages environment, while professional grassland management and pasturing can provide significant development in meat, milk, leather and wool production, parallelly improving soil productivity, decreasing soil erosion and deflation. Consequently, it is not the ruminant livestock species that mean a risk from environmentalaspect, but unprofessional management technologies, and industrial production of agricultural and animal product imitations.

Grazing animals show an example to solve one of the largest problems of this age: how to use the enormous amount of biologically degradable biomassa, supporting the protection of atmosphere and ground-waters, and increasing organic matter content of soil.

Keywords: fibre degradation, ruminants, microbes, grassland, environment

INTRODUCTION

Respect of animal husbandry has always been changeable by areas, depending on the level the livelihood of actual society depended - either directly or indirectly - on this sector. Possibilities of animal breeding have always been strongly determined by local aptitudes and technical-, technoligical niveau of the certain era. These had impacts on habits and traditions in local animal husbandry; and what is more, had effects on historical and social development processes. Recently - due to the fast scientific and technological development - production has been divided from consumption. Different methods have been developped to substitute dairy and meat products (e.g. margarine, artificial meat) for a wider choice.

As a result of urbanization, abundance of foods and information, opinions about animal husbandry and livestock products are highly influenced by trends governed by business interests. It makes the situation more serious that being in lack of scientific knowledge, a wide range of the society can easily be manipulated. That is why it is very important to ensure relevant, science-based pieces of information to the society. This helps the development of agriculture and animal husbandry; supports healthy nutrition, environment- and landscape preservation.

The aim of this review has been clear to experts for a long since: it is a summary of curriculum and scientific results that systematically clarifies the role of animal husbandry (especially that of grassland based ruminants) in sustainable development, healthy nutrition, and environment protection in order to help promotion and development of domestic animal husbandry sectors.

LITERATURE REVIEW

Animals and their environment (role of autotrph and heterotroph organisms on environment)

Since the appearance of life, all organisms have effects on environment through their metabolits. According to laws of chemistry, biology, biochemistry, they take part in the cycle of elements; and use the energy provided directly by the sun, or released from organic materials indirectly.

Autotroph organisms (plants) build up their protein, fat, carbohydrate and vitamine contents from soluble nutrients using the energy obtained by photosynthetic or chemosynthetic processes. Their direct or indirect C and N source is CO_2 and N_2 content of the atmosphere (Boross 1993; Pál 2013; Vadstein et al. 2012; Cole et al. 2014; Terrado et al. 2017; Peirano et al. 2019; Zhang et al. 2020). Heterotrophs (animals) use primary nutrients (protein, fat, carbohydrate) syntethized by autotroph organs, or with the insertion of other heterotroph species (Vadstein et al. 2012; Cole et al. 2014; Terrado et al. 2017; Peirano et al. 2019; Zhang et al. 2020). Nutritive elements (C, N, K, P, etc.) for autotroph organisms return to the environment from inferior and superior autotroph organisms. As a result of their metabolic functions, heterotrophs release gases (mainly CO_2, CH_4 and NH_3) and organic materials that are beneficial for soil organisms and help to maintain nutritive content of soil (Boross 1993; Pál 2013; Terrado et al. 2017).

Degradation of dead heterotroph organisms (rottening, fermentation) – in which microorganisms play a decisive role - is also a basic part of natural cycle of elements.

Consequently, autotroph and heterotroph organisms definitely infulence and control their environment even without presence of superior living creatures. Without fibre degradation (see later) plant residues are deponed in soil - storing solar energy in chemical bonds– in the forms of lignit, brown coal or hard coal (Cooper 2009; Pápay 2011; Molnár 2012; Ontl and Schulte 2012; Gács 2013; Hamed et al. 2016; LeNoé et al. 2019; Yao et al. 2020) . Without fibre degradation, carbon originated from atmospheric CO_2, is deponed much longer. Natural gas and oil beds are the results of microbiological degradation processes of formerly lived organisms under oxygen-free circumstances, where carbon content of atmospheric CO_2 was deponed as methan and other carbon compounds.

Role of superior organisms in cycle of elements, especially in fibre degradation

A basic problem with professional judging of animal husbandry is that a large part of the society is not aware of the main differences between nutrition and digestion-biology of herbivorous and omnivorous species. They do not exactly understand the basic principles and importance of fibre (cellulose) degradation. Cellulase enzym activity, that is responsible for hydrolysis of celluleos, is a characteristic of procariotes (bacteria) (Bhat and Bhat 1997; Mandels 1975; Glick and Pasternak 1989; Dienes 2006; Galbe and Zacchi 2012; Bajaj and Mahajan 2019; Chakraborty et al. 2020). Only these organisms are able do degradate cellulose, consequently, they have a decisive role in carbon cycle. Among superior herbivorous animals, only the species that have symbiotic procariotes in their digestive tract are able to digest forages, which means the vegetative parts of plants (stem and leaves) with high fibre and low energy content. It was like that in the prehistoric times in case of already extincted vertabrate herbivorous species (e.g. herbivorous dinosaurs) and it similar today in all wild or domestic herbivorous animal species (e.g. in rumen of cattle, sheep, goat; in appendix of rabbit and goose). However, cellulose degradation ablilty of omnivrorus species – which are fed on concentrates from nutritional aspect – is highly limited. Consequently, they consume rather the generative parts of plants (e.g. grain crops, leguminous seeds, oilseeds) and – under natural circumstances –animal origined feeds like insects, eggs, animal residues). Therefore in nature, fibres are degraded in a regulated system (pH, humidity, temperature, etc.) in the gastrointestinal tract of superior herbivorous species by symbionttic microorganisms. However, among livestock species, ruminants are the most attacked for having harmful effects on environment.

Since for almost a decade, nutrition science trainings have been based on the introduction of digestion process of ruminants, they will not be discussed in this article. Although, it must be emphasized that degradation and utilisation rate is alwasy efficient and well regulated in these species. Undegraded part of nutrients and unused decomposition products are released by faeces and urine, and under appropriate circumstances improve productivity, nutritive content, water content of soil (Hoffmann et al. 2013; Caia et al. 2019; Ozlu et al. 2019; Tasi 2019; Nauman et al. 2020). This can be made more efficient with adequate manure management (Gruber 1954; Bánszki 1993; Török et al. Hoffmann et al. 2013; Palma 2019; Innocent et al. 2020; Nauman et al. 2020).

Specialities in digestion system of herbivores and its evolution process should be taken into account in the development of new methods for controlled degradation of biomassa that can not be used for anything else. The basic difference is – apart from technological methods – in the input materials, in planned completion of the whole process and in optimalizaton of the procedure. Thus, ruminants show a solution to one of the most important promblem of the age: to the utilization of the high quantity unattended biologically degradable biomassa while promoting soil and water protection and increase of organic matter content of soils.

It has to be amphasized that only herbivores can use vegetation of large grassland areas without any technological help; and in the same time, improve its condition and productivity through the grazing process and their manure while ensuring milk, meat, leather, wool, etc. supplies for humans. No matter ho - spontaneously in nature or by industrial process – the degradation of organic materials happens, at the end the original status is set back. In case of carbon, CO_2 and CH_4, in case of nitrogen nitrogen oxydes and N_2 is produced being energetically the most stabil forms of these elements. (Howard and Farrington 1958; Notheisz and Zsigmond 2008; Roman-Perez et al. 2010; Borsodi 2013; Strangeland et al. 2017; Ranjan et al. 2019; Ulmer et al. 2019; Vignesh et al. 2020). How humankind uses biologically degradable biomass; how long and what organic materials are carbon and nitrogen fixed in; highly depends - in case of human interference – on humans

Role of soil microbes in carbon and nitrogen cycle

Concerning greenhouse gases, soil represents two adverse processes. In the aspect of carbon, it serves as a storage, while formation and amission of CO_2, methan and nitrogen-oxides also happens in soil. These processes are mainly tied to soil microbial activity, organic matter turnover - so biologically to N and C cycles (Yamulki and Jarvis 2002; Chapuis-Lardy et al. 2007; Bardgett et al. 2008; Voigt et al. 2017; Abagandura et al. 2019). Level of gas emission highly depends on actual water content, temperament, microelement supply and pH of soil (Ludwig et al. 2001; Schlaufer et al. 2010; Oertel et al. 2016; Hénault et al. 2019; Wu et al. 2020), and also, on the type of ecosystem *(Table 1.)*.

Table 1: Percentages of global forest, grassland and ploughland areas between 1987 and 2017. (Source: FAO 2020)

	Year			
	1987	1997	2007	2017
Fotests	31,33%	30,95%	30,73%	no data
Grasslands	25,25%	26,17%	25.76%	25,12%
Ploughlands	11,34%	11,42%	11,49%	11,97%

Soil transpiration, which includes CO_2 release, is a natural process and is a result of metabolic processes of roots and microbes. Emission of roots, which is strongly influenced by vegetation period, species and breed, can reach 50% of the total respiration (Hanson et al. 2000; Gonzalez-Meler et al. 2004; Wang and Liao 2004; Busary et al 2015; Dusenge et al. 2019; Collatli et al. 2020; Krauss et al. 2020). Among areas with different greenhouse gas emissions, the greatest differences are in methan and CO_2 emission *(Figure 1.)*.

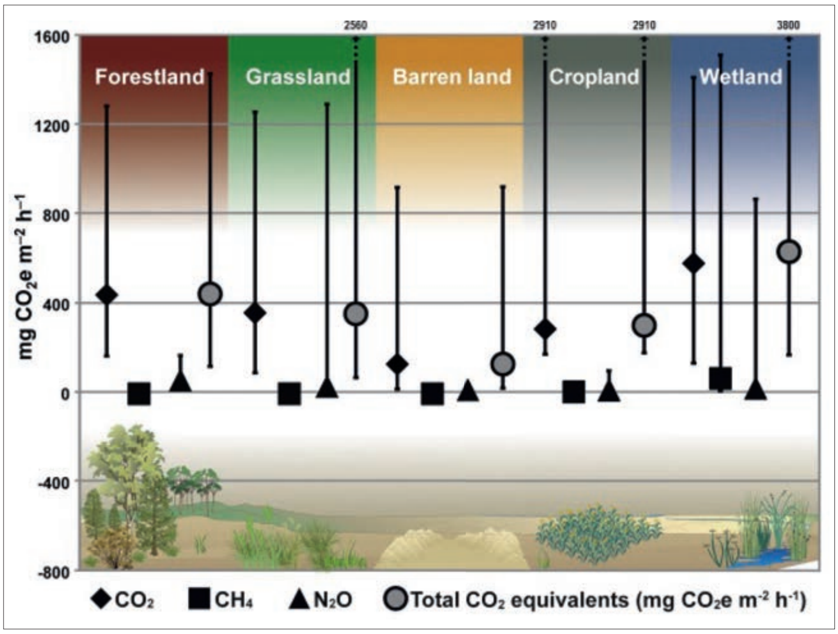

Figure 1: GHG emissions (CO_2-eq) of CO_2, N_2O and CH_4 from soils with different land cover
Source: Cornelius et al. 2016

By now, several pieces of information have been revealed concerning the effect of soil tillage on CO_2 emission. Effect of soil tillage can be 5% of total emission, consequently soil tillage methods that promote preservation of soil C storage, thus decrease CO_2 emission, have became more and more popular (Rádics et al. 2015; Dusenge et al. 2019). Under anaerob circumstances, due to activity of methanogen bacteria, organic material content of soil is turned to methane, which is partly converted to CO_2 by oxidating bacteria. Methanotroph bacteria also join methan flow: under anaerob conditions by methane production; while in the presence of oxygen by CO_2 production from methane (Hanson and Hanson 1996; Butterbach-Bahl et al. 2013; Szafranek-Nakonieczna et al. 2018; Kuzniar et al. 2019).

Nitrogen compounds appear in soil between wide ranges of oxydation level. Nitrogen balance of soil is highly influenced by biological and chemical nitrification and denitrification processes. N_2O and NO, being important as greenhouse gases, are produced in two steps. The first is the aerob nitrification process, in which nitrite and nitrate ions are produced from ammonia. The second is the denitrification, which briefly covers the reduction of nitrate ions into N-contented gases. However, denitrification is a difficult process, consisting of several steps catalysed by enzimes which are related to microbial activity. In a wider sense, during assimilative denitrification, microogranisms build up their N-contented organic materials (which remain in the soil) from nitrate. In a narrow sense, nitrate ions are reduced into gases (N_2O, NO, N_2) and escape into the atmosphere. This dissimilative process is carried out by facultative anaerob microorganisms that under areob conditions use nitrate or nitrite. Dinitrogen-oxyd (N_2O) is produced usually in anaerob environment, e.g. on flooded areas (Bremner et al. 1980; Ussiri and Lal 2013; Reddy and Crohn 2019). During this process, a small quantity of NO is released as well (Brümmer et al. 2008; Wen et al 2016). N_2O production is also possible among aerob conditions; althouhg in small quantity, it was experienced in the nitrification process (Robertson and Tiedje 1987; Stevens et al. 1997; Ussiri and Lal 2013; Liu et al. 2016; Prosser et al. 2020). Consequently, C and N cycle in soil works in the absence of soperior animal species as well – its form and extent depends on soil condition. The process can be influenced by human activities - like soil tillage, vegetation, crop rotation and fertilization - to a lagre extent.

Importance of grasslands

Grasslands are present in all continents except for the North- and South Poles, mountains with high altitudes, and extremely dry desert zones. Right after the forests, grasslands and pastures are the second most important terrestrial ecosystems (Bodnár et al 2002; O'Mara 2012; Bengtsson et et al. 2019). Terrestrial surface of Earth (134 million km2) is covered by forests in 30-31%, by grasslands in 26%, by fieldlands in 10-11% and by other lands in 6.8%. (*Table 1.* FAO, 2020). Adding savannahs, scrogs, forest pastures and tundra, grasslands account for almost 40% of the continental Earth (FAO, 2020). Most grasslands are located in Africa (26.8%), followed by Asia (excluding post-soviet Asian member states 22.7%), South-America (14.7%), Australia and Oceania (12,9%), North- and Central America (10,7%), the post-soviet Asian and European states (9.7%), and Europe without the post-soviet member states (2,5%) (FAO 2020).

Natural grasslands can be divided into three categories (Wesche et al. 2016): 1. Tropical savannahs, which are never affected by frost. 2. Steppes are extratropical grasslands that have evolved on areas that are too dry for forest vegetation. 3. Polar alpine grasslands are located on areas that are too cold for forests.

Multifunctional grasslands contribute to livelyhood of more than 2 milliard people, out of which 600 millions live on dry areas. These lands ensure feedstuff for more than 360 millions of cattle and 600 millions of sheep and goats (Huntsinger and Hopkinson 1996). Due to social-policy reasons, grassland areas are rapidly decreasing in many tropical countries (Nippert and Briggs 2014; Bond 2016; Squires et al. 2018; Thomas et al. 2019). Managed (grazed or harvested meadows) and sown pastures are gaining more and more importance and are basic sources of pasture-based animal production all round the world (Zhaoli 2004; Steinfeld et al. 2006; Bengtsson et al. 2019). Area of managed grasslands increased by more than 600% in the last three centuries. Globally, managed grasslands ensured feedstuff for 1.5 milliard animal units in 1990 (Asner et al. 2004). Animal husbandry is an important source of income and a possibility for employment on rural areas. 38% of the world's population live on grasslans, most of them belonging to the poorest social classes (Bain 2010; Nalule 2010; Zhao et al. 2020). The largest part of them live on arid and semi-arid grasslands of the sub-Sahara region and in South- and East Asia (Squireset al. 2018). It is important to emphasize that these grasslands play a definitive role in supplying the exponentially growing population with food, and this has to be maintained in the future as well (Bodnár et al. 2004; Bain 2010; Zhao et al. 2020).

However, grasslands are globally endangered. Hundreds of documented cases prove spreading afforestation on semiarid, subtropical grasslands of North- and South America, Africa and Australia and other regions (Nippert and Briggs 2014; Squires 2015; Bond 2016; Thomas et al. 2019). Concerning semi-natural grasslands, being known mostly on conventional cultural areas like Europe and in a smaller amount in Eastern Asia, other dangers have to be faced (Dengler et al. 2014; Janssen et al. 2016). The most important ones are intensification of agricultural sector and quitting pasturing on marginal fields. Both can lead to drastic changes in biodiversity of grasslands (Squires et al. 2018; Thomas et al. 2019). Consequently, porfessional use of these fields is of crucial importance. To attain this, first the primary aim of grass management has to be clarified clearly.

Concerning production and animal husbandry, aims of grassland usage can be as follows (Póti 2019): – use of different conditional and non-conditional grasslands for special reasons (land use, nature preservation, heritage preservation, etc.) – professional use of agriculturally improved conditional and non-conditional perennial or annual grasslands, – use of non-agricultural lands like dams and floodplains as pastures (grazing or harvesting).

In animal husbandry associated grassland management, the basic aim is to satisfy actual demands of animals and plants. Thus, annual animal density and grazing technology have to based on availability of grassland and ploughland forages, as well as on quantity and quality of available agricultural and industrial side products that can be used as feedstuff. To let pasturing and grassland management - besides feedstuff, food, and industrial commodity production – serve environment (soil, water, air) and biodiversity, grasslands have to be defined as technological areas; and elaboration and application of comprehensive usage and management technologies is inevitable (Póti 2019).

Role of vertebrata in development of grassland ecosystems

In the evaluation and development of grassland-based animal husbandry it is of crucial imoprtance – even for laity - to be aware of the fact that vegetation of grasslands was evolved together with the native herbivore species (Olff and Ritchie 1998; Bakker et al 2006; Dengler et al. 2014; Zhong et al. 2014; Bon et al. 2020). Their evolution was basically determined - besides the climatic, geographical, geological situations and changes - by parallel development of vegetation, herbivores, and other animals (amphibia, insects, reptiles, birds, predators, scavengers, omnivorous species) as well. This interaction was and is of crucial importance in the past and present as well, resulting in a continuous alteration. (Owen 2008; Zhong et al. 2014; Bon et al. 2020). Consequently, herbivorous vertebrata species have a definitive role in development of grassland ecosystems – which is not appreciated by most of the modern trends.

Actual number of individuals of different grazing species was determined by potential feedstuff supply and density of predators on the certain area. Species composition of grasslands and biomass production potential were mainly influenced by climate on long term and continuous change of weather on short term. This regulates the number of individuals (herbivores, predators, scavengers, etc.) on the certain area in time and space. However, this can be limited by water shortage and human activities. Effect of year influences flora and fauna of grasslands differently, it is manifested mainly in quantity changes (e.g. number of individuals) in short term. Extreme and/or long term changes can basically alter ecosystem of the certain area and animal behaviour (e.g. wandering to find feedstuff or water). These effects interact with each other and indicate continuous changes. This has to be emphasized, since preservation of the „original state" in itself is impossible, because everything - including environment - goes through a continuous change in the absence of human activities as well.

Nevertheless, human activities determinantly influence natural environment. It also has to be brought out that herbivores, especially ruminants, play a great role in natural cycle of different materials. C and N flow of an area is changing continuously and dinamically, even under natural circumstances without the presence of humans. Grazing has different effects on vegetation. Animals graze selectively, which has an impact on species compostition of grasslands (Metera et al. 2010; Kiss et al. 2011; Zimmermann et al. 2011; Wan et al. 2015; Pakemen et al. 2019). As an effect of trampling, only those species remain that can tolerate it - these are mainly short grasses and dicotylendonous species with rosette (Saláta et al. 2009, 2011; Wrage-Mönnig et al. 2011; Bajnok et al. 2018). It is also important that besides vegetation, grazing has impacts on other animal species (insects, birds, etc.) of grassland as well. If a grassland is not grazed by herbivores (e.g. in case of water shortage), vegetation is parched and sooner or later burned - in this case cycle of materials is shorter - or broken down by microbes (e.g. rottening) which is a longer cycle.

In the absence of grazing animals – which situation, with the exception of some extreme cases, does not happen in nature – species that are suitable for the certain ecological conditions but do not tolerate grazing and trampling start to appear. If this situation occurs on areas where conditions are not favourable for grassland vegetation, sooner or later afforestation takes place with shrubs and trees and its characteristic fauna (Lemaire 2007; Saláta et al. 2012; Szigetvári 2015; Sühs et al. 2020). Elimination of usage (grazing or harvesting) of areas that are naturally suitable for grassland vegatation, results in appearance of species, and consequently phytocoenoses that are unfavourable both from environmental and landscape management points of view. (Gibon 2005; Penksza et al. 2010, Kiss et al. 2011, Szabó et al. 2011, Penksza et al. 2013; Sühs et al. 2020).

In case of professional management, grasslands ensure soil cover round the year, thus being the most effective plant community in soil preservation. A perennial grassland vegetation usually consists of 40-100 plant species in Hungary, ensuring a good diversity. Applying poofessional grassland management processes (soil fertilization, grazing, harvesting), continuous use of pastureland can be sustained for decades with extensive farming and low inputs in comparison with ploughlands; maintaining a system that supports environment (soil, landscape, water, air) preservation, fixes a large amount of carbon, and protects climate. Overgrazing and undergrazing shall be avoided because they both have negative effects on natural succession (Richard and Paustian 2002; Tasi 2010; Kiss 2012; Chao et al. 2013; Zhang et al. 2014; Nagy and Tasi 2017; Wang et al. 2020).

Grassland management systems can be either extensive or intensive. Grasslands are able to maintain themselves and give a certain amount of yield without considerable inputs for a long time, since nutrient content of the soil ensures a basic production level that can be sustained with professional management (especially grazing) for long. Therefore among agricultural sectors, grasslands are the easiest to be maintained by extensive farming, which can include organic farming as well. Obviously, countries with the highest level of organic farming (Australia, Oceania, Austria) have enormous grassland areas (FAO 2020). As a conclusion, presence of grazing animals (e.g. ruminants) on natural grasslands (included savanna, steppe, polar-alpine grasslands) – in case there are no limiting factors (e.g. human activity, water shortage) – is definitively a natural factor in the certain ecosystem. Density is infuenced by actual feedstuff availability and other factors like extreme weather conditions. From ecological view, right after forest vegetation and forest management, grassland management is the second lagrest and most favourable method of soil- and landscape management.

Role and importance of forage-fed ruminants in sustainable development, especially in grassland management

Ruminants, including domestic ruminant species as well, with the application of professional grassland management, have positive effects on plant community and grass cover of grasslands. In the same time, their metabolism supports natural material cycles, in contrast with most of the industrial and other human activities (e.g. transportation) – made visible by *Figures 2. and 3.*

Besides positive effects of ruminants on their habitat and their role in natural cycle of materials; it must be emphasized that animal husbandry produces not only feed commodities, but also industrial ones (e.g. leather, wool, cosmetic commodities). However, recently a lagre proportion of products is made of synthetic plastic materials (polimers – created from fossil oil as primary raw material) of chemical industry like leatherette or synthetic. It is important that during this process – the exploitation of fossil oil and natural gas, installation of factories, energy input, production, waste management, even in case of recycling – a great environmental nuisance arises. Products prepared by this procedure, oppositely to agricultural (animal) products, are not the part of the natural cycle.

Role of organic fertilizers shall not be forgotten as well. Until appearance of artificial fertilizers, availability of organic fertilizer was a limiting factor in crop production.

It also must be emphasized that when estimating footprints of animal products (e.g. beef), besides leaving out of interest their role in natural cycle; needs for inputs

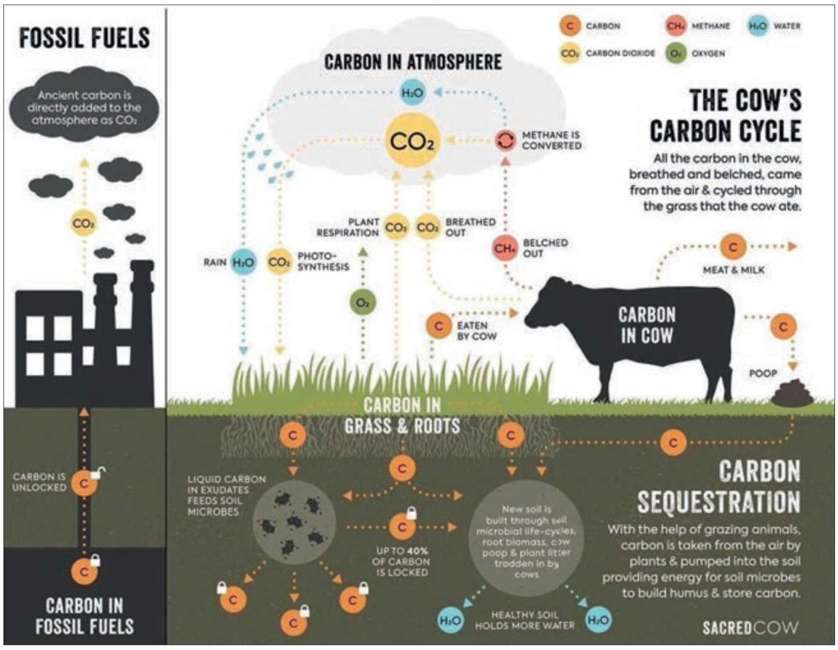

Figure 2: Cattle carbon cycling vs. Fossil fuels
Source: sacredcow.info

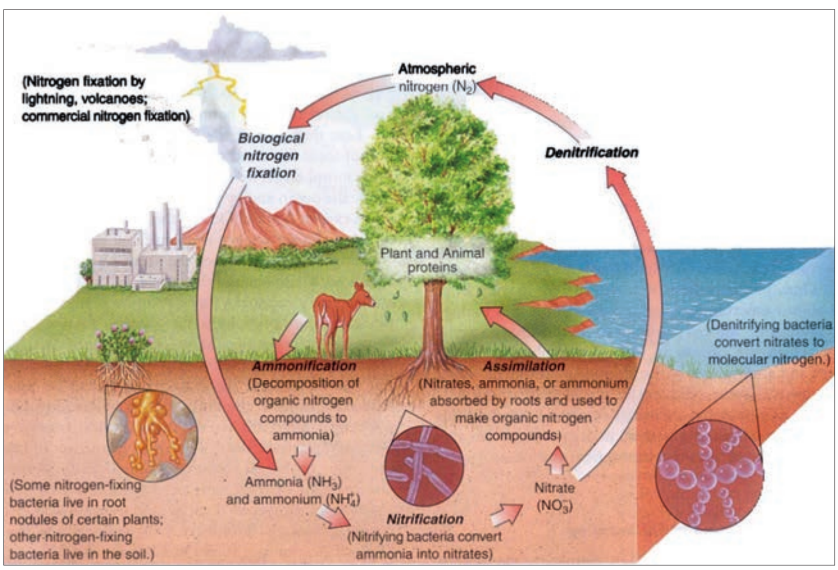

Figure 3: Nitrogen-cycle
Source: britannica.com

(e.g. water) is usually very much angled (Menendez et al. 2019). Apart from urine and feces, cattle lose water with milk (which in case of beef cattle is suckled by calves and also used as a water source), saliva and other secretums, and evaporation. Attention has to be drawn to the fact that in case no grazing animals (e.g. beef cattle) were present on grasslands, vegetation would use water content of soil to the maximum rate, so due to transpiration and evaporation, it would be totally depleted without supply and without utilisation of the produced grass biomass. Besides beef, leather production also has to be regarded in evaluations.

On areas with extreme climatic conditions like semi-deserts that are not suitable for beef cattle, it is possible to produce meat, milk, leather and wool with sheep (D'odorico et al. 2012; Huet al. 2019).

These all are good examples against the science-based (like methan and ammonia release) or not science-based (like water footprint of beef production) arguments concerning the ruminants. Harmful effects of unproffessional management technologies in animal husbandry (e.g. unprofessional pasturing) are also often referred. It is obvious that unprofessional grassland management can be harmful for envirinment. However, professional pasture and grazing management can improve meat supply by 30-35%, and to a lesser extent, milk and dairy products, leather and wool sullpy on global level (Bodnár et al. 2004; O'Mara 2012). In the same time, productivity of soils improve, and risks of erosion and deflation decrease. In conclusion, it is not the ruminants that mean environmental risk, but unprofessional technologies in animal husbandry, the lack ofcompetency, and replacement of agricultural commodities with products of chemical industry.

As a conclusion, it is rather efficient to introduce connections of facts systematically, with professional background and examples of professional practice. This gives the chance for animal husbandry to be well appreciated in the common knowledge, helping the development of this sector of agriculture.

Role of milk and meat in healthy diet and sustainable production

Foods with animal origin, like milk and dairy products, meat and meat products and eggs have often been criticized recently. Since the aim of this review is not the detailed description and comparison of scientific results in dietetics or food science, only some statements supporting the cosnumption of these foods are mentioned. Milk and eggs, independently from species, are foods with whole biological value which means that they contain all nutrients the human body needs, in a rate and form that can be exploited well (Nys 2004; Barlowska et al. 2011; Fox 2011; Guetouache et al. 2014; Getaneh et al. 2016; Thornig et al. 2016; Godbert-Réhault 2019). Originally, in 1968, development of plant components based milk- and dairy product replacers were planned to provide an alternative possibility in fight against starvation in developing countries (Meadows et al. 1972). The replacers were developped the middle '70s; however, their consumption has became popular not in poor areas but in countries with overproduction (mainly int he EU and North-America) as a range expansion.

Consumers rely on plant based products, despite of the fact that these can be produced only after artificial modification of raw materials - so they can not be regarded az natural foods. A contradiction to describe the situation: there is e.g. bio margarine with butter taste. Use of chemicals is limited in plant production phase, but they are not forbidden during the processing phase. It must not be ignored that raw material costs for margarin and other milk product replacers are much less than that of milk, which difference is not experiencable in the prodcut price.

The situation is similar with meat and meat products. Meat is also a whole value protein source for humans which contains all essential aminos acids in optimal quantity (Vén 2010; Pighin et al. 2016; Bohrer, 2017; Wood, 2017). Meat is an excellent source of minerals and vitamines. Natrium and kalium have essential role in ensuring water balance of human body and regulating normal heart rhythm. The ratio of these minerals is optimal in meat (Bohrer 2017; Wood 2017). Meat of ruminants contains large quantity (35-40%) of saturated fatty acids (SFA) which is physiologically unfavourable due to their effect on blood cholesterol level. In the same time, it contains 35-50% mono-unsaturated fatty acids including oleic acid (C18:1) which decreases occurence of cardiovascular diseases (Csapó 2004; Pighin et al. 2016; Bohrer 2017; Holló et al. 2017; Wood 2017). Eicosapentanoic (EPA) and docosahexaenoic (DHA) acids (omega- 3 fatty acids) have anti-inflammatory effects in human body; while overconsumption of omega-6 fatty acids results in release of hormon-like factors (eicosanoids) that enhance inflammatory processes (Simopolous 2008). With a well balanced diet, optimal omega-3/omega-6 rate (between 1:1 and 1:4) can be maintained. In western societies omega-6 fatty acid consumption exceeds omega-3 by 20-30 times. (Simopolous 2008; 2016). To decrease omega-6 intake, regular consumption of fish, shell, and ruminant meat is beneficial. Meat of ruminants contains 3% fat on average, and less then 2% of its calories is originated from omega-6 fatty acids (Daley et al. 2010; Hall 2016; Renna et al. 2019).

For people with various intolerances or allergies, like lactose (Misselwitz et al. 2019; Louwagie 2019), milk protein (Matthai et al. 2020; DeMartins et al. 2020), soy (Denorme et al. 2019), nuts (Faisal et al. 2019; Denorme et al. 2019), mustard (Sharma et al. 2019), celery (Licari et al. 2019), gluten (Fedor et al. 2020; Scherf et al. 2020) consumption of these allergens is harmful, while they can be healthy for the others. Functional development of of products (like lactos free products) enable a wider range of the population to consume dairy and meat products (Dekker et al. 2019; Facioni et al. 2020).

CONCLUSIONS

With their metabolism, autotroph and heterotroph organisms definitely infulence and control their environment (air, soil, water) even without the presence of superior living creatures. Cessulose degradation and cellulase enzym activity is basically a characteristic of procariotes (bacteria); among herbivores, only the species with symbiotic microogranisms in their gastrointestinal tract are able to degrade cellulose. Circumstances (aerob, anarob, temperature, humidity, etc.) under which cellulose (fibre) is degraded in nature by appropriate microorganisms (on soil surface, in soil, in gastrointestinal tract of superior herbivores) or by human interference and industrial technology, basically affect its beneficial value from ecological, environmental, economical and social aspects.

Independently from the way by which degradation of organic materials - produced primary by autotroph creatures – happens; either in nature in microbes and superior animals or by human technologies; at the end of the process the original status is set back. In case of carbon CO_2 and methan, while in case of nitrogen nitrogen-oxides and N_2 are produced, being energetically the most favourable forms of these materials.

Terrestrial land surface of the Earth is in 26% covered by continental grasslands; and regarding savannah, forest and shrub, and tundra grassland types, grasslands cover almost 40% of land areas. More than 38% of the world population live on grasslands. Right after forsets, grassland management is the second most climate preserving use of soils.

Presence of herbivorous grazing animals (e.g. ruminants) is a natural phenomenon in natural grassland ecosystems (savannahs, steppes, polar-alpine grasslands) unless there is a limiting factor (e.g. human activity, water shortage). Their density is regulated by availability of feddstuff and other limiting factors like extreme weather conditions.

Unprofessional use of grasslands damages environment, while professional grassland management and pasturing could provide 30-35% development in meat production, a smaller but significant increase in milk, leather and wool supply; parallelly improving soil productivity, decreasing soil erosion and deflation. Without grass management (grazing or harvesting), on areas that are suitable for grassland vegetation, sooner or later the characteristic vegetation of the habitat (shrubs-forests) will develop with its charasteristic fauna. However, if areas suitable for grassland vegeration are negliged (not grazed or harvested) alien plants and vegatation appear, which is disadvantegous both from environmental and landscape preservation aspects.

Grazing animals show an example to solve one of the largest problems of this age: how to use the enormous amount of biologically degradable biomassa, supporting the protection of atmosphere and ground-waters, and increasing organic matter content of soil. How humankind uses biologically degradable biomassa; how long and what organic materials are carbon and nitrogen fixed in; highly depends - in case of human interference – on humans.

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THE PREVALENCE OF "WORLD VARIETIES" AND OTHER FOREIGN WINE GRAPE VARIETIES IN HUNGARY IN 2015 AND 2020

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ABSRACT

Variety is a key factor in viticulture, as the genetically determined characteristics of each variety are crucial for both the quantity and the quality of the harvest. In this present study the Hungarian presence and significance of the so-called world varieties (like Chardonnay, Riesling, Pinot noir etc.) and other adopted grapevine varieties are evaluated. Our analysis focuses only on the varieties which are registered at the Hungarian wine communities. The investigated 60 varieties cover 34.9 % of the Hungarian vineyards. The total area of adopted varieties further reduced by 2020, similarly to the previous decades. If certain varieties are considered individually, the situation is more modulated. The production area of 24 varieties have reduced, that of 31 other increased, while the area size of 6 varieties is proved to be equal. 13 new items also occured on the lists (7 white and 6 red wine varieties). From 2015 to 2020 the following varieties can be considered as the „biggest losers": Chasselas, Rivaner, Cabernet sauvignon, Zweigelt, Chardonnay, while Cabernet franc, Pinot gris and Syrah increased most significantly.

Keywords: international grape varieties, Hungary, variety sortiment

INTRODUCTION

Hungarian viticulture traditionally works with many varieties. In 2020, the number of wine grape varieties, which are not only of collector's value but also occur in vineyards and are registered in the wine communities, exceeded 130. Hungarian range of varieties is equally rich. As far as the use of varieties in Hungary is concerned - apart from a detailed analysis - it can be concluded that the large number of varieties grown and the abundant range of varieties are not the result of recent times, nor are they the result of an artificially controlled, ill-considered variety policy, or even of irresponsible experimentation on the

part of growers, but are the result of the richness and diversity of the country's ecological (especially climatic) conditions and the economic policy constraints.

In 2020, the National Catalogue of Varieties published by the National Food Chain Safety Office (NÉBIH) lists 103 (78 white, 25 red) state-recognized wine grape varieties.

In the same year, the number of "individually authorized vine varieties for propagation" was 18 (7 white, 11 red), which, together with the previous ones, meant a total of 121 varieties included in the list.
The use of varieties and the composition of varieties cannot be equated. There are listed varieties for which no vineyard area was registered in 2020. At the same time, there are a number of wine grape varieties in the variety composition that are not included in the National Variety Register (NF, 2020) for various reasons (varieties awaiting certification or disappearing from cultivation; wine grape varieties included in the Community Variety Register) (Lőrincz et al. 2015).
In the course of the variety descriptions, in order to review the status of the wine grape varieties included in the study and to quantify their role and importance, we relied on summarized ampelographic works and articles (Bényei - Lőrincz 2005, Csepregi 1997, Csepregi - Zilai 1989, Fazekas - Lőrincz 2014, Hajdu et al 2011, Lőrincz - Fazekas 2015, 2016 a, b, Lőrincz - Sz. Nagy - Zanathy 2015, Tóth - Pernesz 2001, Hajdu et al., 2011).

MATERIAL AND METHODS

In our work, we used the data for 2015 and 2020 provided by the wine communities to the National Council of the Wine Communities (HNT) as the basis for our analysis. We have also considered statistical data from previous years. Thus, we have not only recorded a static picture, but we have also analysed the changes in the variety sortiment since the turn of the millennium until today.
The foreign white and red wine-producing varieties included in the study were as follows:
White wine varieties - Aligoté, Bacchus, Bouvier, Chardonnay, Chasselas, Chenin blanc, Goldburger, Jubileumsrebe, Kerner, Korai piros veltelini, Ottonel muskotály, Pinot blanc, Piros veltelini, Rajnai rizling, Rizlingszilváni, Sauvignon blanc, Semillon, Szürkebarát, Tramini, Villard blanc, Viognier, Zöld szilváni, Zöld veltelini;
Red wine varieties - Acolon, Alibernet, Alicante Bouschet, Barbera, Blauburger, Cabernet Dorsa, Cabernet franc, Cabernet Mitos, Cabernet sauvignon, Carmenere, Cot (Malbec), Domina, Dornfelder, Gamay noir, Hamburgi muskotály, Laska, Marselan, Merlot, Petit verdot, Pinot noir, Pinot meunier, Primitivo, Regent, Roesler, Sagrantino, Sangiovese, Syrah, Szentlőrinc, Tannat, Tempranillo, Zweigelt.

RESULTS

The area of the foreign white wine grape varieties in the years under study (2015, 2020) is presented in Table 1, and that of the red wine grape varieties in Table 2. Only varieties with an area of more than 0.1 ha are shown in the tables. Because of their small area (< 0.1 ha), white wine grape varieties Saphira, Sauvignon gris, Sauvignon Kretos and Soreli and red wine grape varieties Allegro, Blauer Frühburgunder and Bolero are not included.
Table 1-2 shows a total of 61 varieties (30 white, 31 red) in the 2020 total. This is a significant increase compared to 2015, when 48 varieties were included in this list (23 white, 25 red). The number of hybrid varieties is 26 (13

Table 1: Changes in area size of world and other adopted white wine varieties in 2015/2020 (Source: HNT 2015, 2020)

Number	Grape variety	Area		Trend
		2015	2020	
		ha	ha	
1.	Chardonnay	2562	2220	↓
2.	Szürkebarát	1582	1738	↑
3.	Zöld veltelini	1355	1378	↑
4.	Rizlingszilváni	1708	1346	↓
5.	Rajnai rizling	1271	1217	↓
6.	Ottonel muskotály	1247	1214	↓
7.	Sauvignon blanc	945	985	↑
8.	Chasselas	1265	800	↓
9.	Tramini	685	763	↑
10.	Pinot blanc	234	228	↓
11.	Villard blanc	212	225	↑
12.	Bačka (Ister)	-	29	↑
13.	Panonia (Castellum)	-	25	↑
14.	Semillon	51	24	↓
15.	Moscato Giallo	-	17	↑
16.	Viognier	13	15	↑
17.	Chenin blanc	5	6	→
18.	Bouvier	7	5	↓
19.	Korai piros veltelini	7	4	↓
20.	Zöld szilváni	7	3	↓
21.	Hibernal	-	0,8	↑
22.	Piros veltelini	4	0,7	↓
23.	Kerner	2	0,6	↓
24.	Solaris	-	0,5	↑
25.	Muscaris	-	0,4	↑
26.	Bacchus	0,3	0,2	↓
27.	Aligoté	0,1	0,1	→
28.	Kozmopoliten	-	0,1	↑
29.	Jubileumsrebe	0,4	-	↓
30.	Goldburger	0,2	-	↓
	ÖSSZESEN	13163	12221,2	↓

Note:
• Not registered in the National List of Grapevine Varieties (2020): Aligoté, Goldburger, Jubileumsrebe, Kozmopoliten, Moscato Giallo, Muscaris, Pannonija
• Trends: → equal; ↑ increased; ↓ reduced

Table 2: Changes in area size of world and other adopted red wine varieties in 2015/2020 (Source: HNT 2015, 2020)

Number	Grape variety	Area		Trend
		2015	2020	
		ha	ha	
1.	Cabernet sauvignon	2774	2416	↓
2.	Merlot	1923	2148	↑
3.	Cabernet franc	1349	1457	↑
4.	Zweigelt	1753	1408	↓
5.	Pinot noir	1089	1164	↑
6.	Blauburger	442	445	↑
7.	Syrah	203	324	↑
8.	Dornfelder	27	32	↑
9.	Cot (Malbec)	2	17	↑
10.	Alibernet	9	11	↑
11.	Hamburgi muskotály	13	11	↓
12.	Alicante Bouschet	15	10	↓
13.	Petit verdot	4	5	→
14.	Gamay noir	3	3	→
15.	Cabernet Dorsa	2	2	→
16.	Sagrantino	1	2	↑
17.	Sangiovese	1	2	↑
18.	Tannat	1	2	↑
19.	Marselan	2	1,7	↓
20.	Szentlőrinc	2	1,4	↓
21.	Cabernet Mitos	1	1,3	↑
22.	Tempranillo	-	1,1	↑
23.	Acolon	5	0,7	↓
24.	Barbera	-	0,7	↑
25.	Regent	3	0,7	↓
26.	Laska	-	0,6	↑
27.	Primitivo	-	0.6	↑
28.	Pinot meunier	-	0,5	↑
29.	Carmenere	0,4	0,4	→
30.	Roesler	-	0,4	↑
31.	Domina	0,5	-	↓
	ÖSSZESEN	9624,9	9469,1	↓

Note:
• Not registered in the National List of Grapevine Varieties (2020):Acolon, Alibernet, Alicante Bouschet, Barbera, Cabernet Mitos, Carmenere, Domina, Marselan, Petit verdot, Pinot meunier, Primitivo, Regent, Sagrantino, Sangiovese, Szentlőrinc, Tannat, Tempranillo.
• Trends: → equal; ↑ increased; ↓ reduced

white, 13 red). Only six of them are the result of interspecific crosses (Villard blanc, Regent, Roesler, Pannonija, Ister, Kozmopoliten), the rest are intraspecific hybrids (9 white, 12 red). If we only count the varieties grown on more than 10 ha in 2020, there are 26 varieties on the list (15 white, 11 red), compared with 23 in 2015 (13 white, 10 red). The number of varieties with an area of more than 100 ha is not much lower, 18 in total (11 white, 7 red), with no change compared to 2015.

In terms of area, foreign varieties accounted for 34.9% of the total area under vines in Hungary in 2020. The total area of wine grape varieties belonging to the group of varieties under study decreased from 22,788 ha (2015) to 21,690 ha (2020).

A more nuanced picture emerges if we look at the change in the area of the vine varieties individually. Of the varieties in the list, 24 areas decreased (16 in 2015), 18 increased (12 in 2015) and 6 remained unchanged over the period. At the same time, 15 varieties were not included in the list of varieties with 'separate area' in 2015.

In the following, the wine grape varieties included in the study are evaluated one by one, separately for white wine and red wine.

Foreign white wine varieties

- Chardonnay is the second most widely grown variety in the foreign group after Cabernet Sauvignon. It has maintained its position, although its area has started to decrease in recent years (by 13% between 2015 and 2020).
- Rajnai rizling has a narrower distribution than Chardonnay. The area under vines has also decreased, by only 4%.
- The interest in Semillon is waning due to its defects (susceptibility to frost, high tendency to rot, etc.) and its area is in constant decline (83 ha in 2001, 65 ha in 2005, 51

ha in 2015, 24 ha in 2020). Since the turn of the millennium, Semillon has therefore lost more than 70% of its plantings.
- The area under Rizlingszilváni has fallen by 21% in the period under review (2015/2020).
- Among the higher yielding varieties, Chasselas suffered a 37% decline between 2015/2020.
- For the Zöld veltelini the decline in area stopped between 2015/2020, with a minimal increase in area.
- Two of the three varieties belonging to the Pinot conculta (Szürkebarát, Pinot noir) increased their area over the period. The most spectacular improvement was in the case of Szürkebarát, with a 9% increase.
- Ottonel muskotály, one of the varieties producing muscatel wine, saw its area decrease marginally (2.6%) by 2020.
- Sauvignon blanc and Tramini are aromatic varieties. Plantings of both are on the increase. The area planted with Sauvignon blanc increased by 4% between 2015 and 2020 (with a steady increase after the millennium), while Tramini showed a larger decrease (-14%) between 2005 and 2015. In the last five years, however, its area has increased by 10%.
- Villard blanc is an interspecific hybrid with a spectacular increase in area in the Great Hungarian Plain since 2005.
- Among the vine varieties, the newly introduced Serbian-bred resistant varieties are Bačka (Ister) (29 ha) and Panonia (Castellum) (25 ha). Their appearance is related to the Great Plain. Moscato giallo (17 ha) is a new Italian variety not yet cultivated in the country.

Table 3: Categorization of the investigated varieties based on the time of ripening (2020)

Number	Time of ripening			
	Early	Medium	Late	Very late
1.	Bacchus	Acolon	Alibernet	Alicante Bouschet
2.	Bouvier	Blauburger	Aligoté	
3.	Chardonnay	Barbera	Cabernet franc	
4.	Chasselas	Cabernet Dorsa	Cabernet Mitos	
5.	Jubileumsrebe	Chenin blanc	Cabernet sauvignon	
6.	Korai piros veltelini	Domina	Carmenere	
7.	Kozmopliten	Dornfelder	Cot (Malbec)	
8.	Laska	Goldburger	Gamay noir	
9.	Muscaris	Ister	Hamburgi muskotály	
10.	Ottonel muskotály	Kerner	Hibernal	
11.	Panonia	Moscato Giallo	Marselan	
12.	Pinot meunier	Pinot blanc	Merlot	
13.	Primitivo	Pinot noir	Petit verdot	
14.	Rizlingszilváni	Piros veltelini	Rajnai rizling	
15.	Roesler	Regent	Sagrantino	
16.	Solaris	Sauvignon blanc	Sangiovese	
17.	Szürkebarát	Semillon	Syrah	
18.	Tempranillo	Szentlőrinc	Tannat	
19.	Tramini	Zöld veltelini	Villard blanc	
20.	Viognier	Zweigelt		
21.	Zöld szilváni			

Note:
- early ripening – in the first half of September,
- medium ripening – in the second half of September,
- late ripening – in the first half of October,
- very late ripening – from second half of October.

- Viognier is a French variety. Registered area 6 ha in 2011, 13 ha in 2015 and 15 ha in 2020.

The twelve varieties cultivated on less than 10 ha in 2020 include Korai piros veltelini (4 ha), Bouvier (5 ha), Zöld szilváni (3 ha), Piros veltelini (0.7 ha), which have been present in our country for a long time and are of local importance but could disappear from our vineyards soon if current trends continue. At the end of the list there are several hybrid varieties produced in Germany, such as: Hibernal (0.8 ha), Kerner (0.6 ha), Solaris (0.5 ha), Muscaris (0.4 ha), Bacchus (0.2 ha). Foreign varieties grown on a small area are the French Aligoté (0.1 ha) and the Serbian/Hungarian Kozmopoliten (0.1 ha). The two varieties previously included, Jubileumsrebe and Goldburger, have disappeared from cultivation.

Foreign red wines varieties

- In 2015, five world varieties were ranked in the top 10 of the regional ranking of red wine grape varieties: Cabernet sauvignon, Merlot, Cabernet franc, Pinot noir and Syrah. They are found in many wine regions and are among the dominant varieties in our red wine regions. Eight of the top 10 varieties have increased in area over the last five years, while Cabernet Sauvignon and Zweigelt have decreased. Syrah quadrupled its area between 2005 and 2015 (from 47 ha to 203 ha) and its dynamic expansion has continued, with 324 ha now in production. It is noteworthy that in 2001 there were only 9 ha of Syrah planted in Hungary.
- The area under Zweigelt decreased by 35% (almost 1000 ha) between 2005 and 2015 and by a further 20% between 2015 and 2020.
- In 2020, the foreign red wine grape varieties grown on more than 10 ha included Dornfelder, Cot (Malbec), Alibernet, Hamburg Muscatel, Alicante Bouschet.
- The foreign varieties grown in 2020 on less than 10 ha include hybrids (Alibernet, Acolon, Marselan, Cabernet Dorsa, Cabernet Mitos, Domina) and resistant varieties such as the German Regent and the Austrian Roesler. Some varieties are widely grown in foreign countries (Chile - Carmenere, Argentina - Cot (Malbec) and in European public cultivation: Austria - Szentlőrinc, Laska, France - Gamay noir, Petit verdot, Pinot meunier, Italy - Sagrantino, Sangiovese, Barbera, Primitivo, France (Uruguay) - Tannat). Their current weight in the varietal composition is negligible, measured in hundredths of a percent.

The grouping of varieties according to their time of ripening is shown in Table 3. The classification refers to years with average weather conditions. Because of weather conditions which are different from the average, and which have been abundant in the last two decades, the ripening intervals may change by 1-2 weeks or even more, starting earlier or later in calendar time. Among the varieties examined, there is no very early ripening and only one very late ripening variety, Alicante Bouschet. In terms of the number of varieties, 21 (12 in 2015) are early maturing, 20 (16 in 2015) are medium maturing and 19 (19 in 2015) are late maturing. The numbers indicate an increase in the variety range. Looking at the regional share of each maturity group gives a more favourable picture. In 2020, the area of early maturing varieties was 8137.4 ha (37.4%), that of medium maturing varieties 5722.8 ha (26.3%), that of late maturing varieties 7844.3 ha (36.1%) and that of very late maturing varieties 10 ha (0.04%). Varieties belonging to the latter two ripening groups are highly sensitive to the vintage, as early and medium ripening varieties can be grown safely under the climatic conditions in Hungary, especially in hot weather. Late and very late maturing varieties may be affected by early autumn frost. Since the 1970s, a conscious breeding policy in Hungary has increased the number of early and medium-mature varieties in the variety selection, and as a result their weight in the variety composition has also increased. Looking at the foreign varieties from this point of view, in 2020 2/3 of their total area was occupied by varieties that mature by the end of September - beginning of October.

CONCLUSION

- In 2020, 28 (23 in 2015) foreign wine grape varieties (16 white, 12 red) were grown on an area of more than 10 ha. The number of varieties with an area of more than 100 ha is ten less, namely 18 (11 white, 7 red). The area of 11 varieties exceeded 1000 ha. These accounted for 81.6% of the total area of the varieties analysed (white wine varieties: Chardonnay, Rizlingszilváni, Szürkebarát, Zöld veltelini, Rajnai rizling, Ottonel muskotály; red wine varieties: Cabernet Sauvignon, Merlot, Zweigelt, Cabernet Franc, Pinot Noir).
- The 60 varieties under study represent 34.9% of Hungary's total vineyard area in 2020.
- The area under "foreign" wine grape varieties will continue to decrease in 2020, as in the past decades (8.8% in total; white 7.2%, red 1.6%).
- If we look at the change in the area of each vine variety individually, a more nuanced picture emerges. Of the 60 varieties included in the list, 24 have decreased, 31 have increased and 6 have remained unchanged over the period, while 13 newcomers have also been included, 7 white and 6 red varieties.
- The varieties with the largest area losses between 2015 and 2020 are Chasselas (-465 ha), Rajnai rizling (-362 ha), Cabernet Sauvignon (-358 ha), Zweigelt (-345 ha) and Chardonnay (-342 ha). The largest increase in area was for Cabernet franc (+225 ha), followed by Pinot Noir (+156 ha) and Syrah (+121 ha).
- Of the 60 varieties included in the study, 21 were early ripening, 20 medium ripening and 19 late ripening.
- In 2020, the area of early ripening varieties was 8137.4 ha (37.4%), that of medium ripening varieties was 5722.8 ha (26.3%), that of late ripening varieties was 7844.3 ha (36.1%) and that of very late ripening varieties was 10 ha (0.04%). Maturation time is a very important factor for the safe cultivation of the variety. Early and medium maturing varieties accounted for 2/3 of the total area.
- There are several reasons for the change in area of 'foreign' wine grape varieties. Perhaps the strongest impact is due to changes in market demand. In addition to the lack of replanting of less sought-after varieties, new varieties are being introduced. The abundance of varieties and wines on offer creates strong competition for grape varieties. And the reduction in the size of vineyards does not allow the cultivation of less sought-after varieties. In some cases, the less favourable characteristics of the varieties also contribute to their loss of area. Finally, the role of changes in climatic factors in variations in variety composition is receiving increasing attention.

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LOVE FOR THE LAND INHERITED BY OUR ANCESTORS

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ABSTRACT

This paper investigates the emotional connection between the farmer and the lands they own. If they inherited their lands from their ancestors are they emotionally invested in it? Can an individual form an emotional bond with a geographical location based on personal history and an ancestral connection? I seek to provide proof about the existence of this phenomenon with the assistance of local farmers (6 individuals) through interviews (20-40 minutes long, due to dialect differences no transcription was made). After showcasing the gathered evidence from these sources, that proves my thesis correct, an emotional bond can form between a farmer and their land, I would highlight what kind of actions and events might cause the formation of such bonds and provide some history related to land ownership in Hungary.

keywords: land, collectivization, ancestry, history, connection, bond, system

INTRODUCTION

Nowadays, due to the recent series of crises the global supply chains encountered multiple problems (food shortages in certain regions, increases in prices), so people started to rely more on local or domestic produce. It should be also noted, that the Hungarian government began to increase the funding of the agricultural sector (Hungarian Village Program, National Afforestation Program), the government began to support the self-sufficient lifestyle.
However I should note, when it comes to farmland, economics isn't always the first measure of value. The land that provides livelihood for the family or a land that might have been in the possession of a family for generations might create an emotional connection with those who maintain it (Rákóczi 2016). This can be deeply personal bond and is often tied to the feelings of not wanting to disappoint our ancestors, disappoint our families. In the following article I'd like to talk about the existence of such emotional bonds and provide some insight into the recent history of land ownership in Hungary.
In 1948, the Communists took power with Soviet help, but their goal was not to promote and spread the useful form of cooperative activity, but to abolish private farming for political reasons, to control the rural agricultural population closely, and to service industrialization from an economic point of view, to take the capital invested into agriculture and redeploy it into the industry, and to provide the labor needed for the emerging heavy industry by attracting rural surpluses to cities. The Hungarian Workers' Party, led by Mátyás Rákosi, envisioned the creation of a collective farm system modeled on modernization. This collectivization effort was carried out mainly by violent methods (intimidation, propaganda, show tirals), which provoked resistance from the people (this was one of the many reasons that sparked the 1956 Revolution).
After the fall of the Soviet Union in 1992, the first freely elected parliament enacted the so-called Cooperative Transformation Act. In this, the law stipulated that producer cooperatives were required to pay not only to retired and working members of the assets accumulated over decades, but also to all those who had worked in the producer cooperatives for at least five years (MNL 1982).

MATERIAL AND METHODS

I collected the data for my research in Békés county. The county is located in the Southern Great Plain region of Hungary, its seat is Békéscsaba. It has an area of 5631.05 km2, 9 districts (Békéscsaba, Békés, Szeghalom, Gyomaendrőd, Szarvas, Orosháza, Mezőkovácsháza, Gyula, Sarkad) in which there are 75 settlements (1 county town and 21 other cities) according to Central Statistic Office surveys in 2018 about 338025 people live in Békés county with an average population density of 66.8 people / km^2 (KSH 2013, KSH 2018) Békés county is located in the Great Plain, its area is flat. The plain between the Körös-

Maros and the Körös-Berettyó region is almost perfect (Bulla 1968). The altitude of the county fluctuates around 81-106 meters above sea level. The area of the county is covered with a thick layer of sandy-loess sediment. The most significant mineral treasure of the county is natural gas. The continuity of the plain is divided by the relatively dense river network. The county has 8 rivers by number: the Körös (Fehér, Fekete -, Kettős -, Sebes - and Hármas-Körös), Berettyó, Száraz-ér, Hortobágy-Berettyó (Pécsi 1969; Marosi 1990).
In the course of my scientific research I would like to explore the emotions, motivations and suggestions of the people who live and farm in the scenery . For the exploration of the range of issues, the detection of cause and effect correlations, the understanding of processes and for solution options I used a methodology of social sciences, the so-called structured interview. I conducted a total of 6 structured interviews with farmers in Marc 2021 in the territory of Békés County. For the purpose of easier processing, audio recordings were also made of the interviews, by means of a Dictaphone. The length of these was 1 hours in the case of experts, and over 2.5 hours in the case of the affected people. A verbatim transcript was not made of the interviews. During the interviews I also used a pre-printed datasheet containing a series of questions. A literal transcript of the interviews was not made. I based the interview on the methodology described in the book made by Heltai and Tarjáni (Heltai és Tarjáni 1999). The completed interviews were subjected to quantitative evaluation and content analysis based on the methodological suggestions of Babbie (2003) and Newing (2011). The data of the interviews with the farmers concerned are illustrated in the table below (Table 1.).

Table 1: The data of the interviews with the farmers

Surename	Age	Profession
Mihály	77	Primary producer
Pál	67	Primary producer/ Primary Family Farm
Pál	76	Family maintaned Limited company.
Tibor	47	Primary producer/Site manager
Zsombor	41	Family maintaned Limited company.
Lénárt	42	Primary Producer

RESULTS

Examining the interviews it can be seen that the local farmers successfully formed emotional attachments to their lands. I would like to highlight the following words from the interview to further illustrate this (please note, that the original language of the interviews was Hungarian and the interviewed farmers mostly spoke with dialects).
"…My parents were peasants too, until the 50's, when the system came, we had to give up our land for the producer cooperative, they worked there until the system changed once again, then we reclaimed the land as compensation and started working on it as farmers once again even as pensioners, then I took over and started raising animals, as the land wasn't much but it was ours… " /Mihály, age 77/
"…We've been working in the agricultural sector since '82, after '83 we started to cultivate medicinal herbs and grain crops (…) after the change in the system we bought more land and begin to raise crops with greater intensity (…) we are a primary family farm… I have two sons, both have higher educational degrees…the future of our farm is insured…" /Pál, age 67/
"…I was born on my grandfather's land, it was a 57 jugerum land he tended to that with his son and his sibling, later we moved (…) where my father was given a 16 jugerum land by his father. In 1950 we had to move as half of our house was taken away (during the Rákosy system) (…) during the system change, the privatisation (…) we reclaimed 100 hectare land (in the proximity of the old holdings)…" /Pál, age 76/ (Figure 1.)
"…I've been working in the agricultural sector for 10 years now (…) my lands were inherited and bought mostly…" /Tibor, age 47/ (Figure 2.)

Figure 1: Land in the Békési-hát (Photo: Rákóczi 2019)

Even if this is not fully perceptible in the text format, the farmers were noticeably proud of their farms during the interviews (body language, emphasis). They felt that they have years of experience, they actually know the lands they cultivate, their land is important to them. It was noticable that they care about their lands, they aim to improve it and protect it from harm. They wish to once again ensure that their lands will become the legacy of their family.
It should be also noted, that those farmers, whose ancestors owned certain lands before the collectivisation efforts of 1948 for generations, aimed to reacquire those specific areas once again after the events of 1992, even if there were more favourable lands available.

Figure 2: Land in the Kis-Sárrét (Photo: Rákóczi 2016)

In summary as seen on Table 2. :
• 4 out of 6 individuals mentioned connections to their land related to their ancestry
• All 6 individuals were noticeably passionate when talking about the history of their land.
• All 6 of them became protective of their land when they began to talk about the problems they encountered in the past (problems caused by the climate change mostly) that might cause negative effects for their holdings.

Table 2: Noticable informations mentioned during the interview

Surename	Ancestral connection?	Emotional undertones?	Protective behaviour?
Mihály	Yes	Yes	Yes
Pál (76)	Yes	Yes	Yes
Pál (67)	Yes	Yes	Yes
Tibor	Yes	Yes	Yes
Zsombor	No	Yes	Yes
Lénárt	No	Yes	Yes

DISCUSSION

There's more to farmland value than economics. Farmers may place emotional attachment to the land they farm. The manifestation of an emotional bond between a farmer can happen, provided there is a foundation for such thing to occur (ancestral connection, important personal memories).

CONCLUSIONS

The main goal of my hypothesis was to prove, that emotional attachments can form between a farmers and their land, they have the capacity to love, to protect their holdings from harm based on their feelings, memories connected to it.
My hypothesis was confirmed, the interviews with farmers prove, that if given the chance, either through the passage of time or through ancestral connections, the farmer can form an emotional attachment to the land they own.
The creation of such a bond can be a boon for the agricultural sector, as the farmer will be motivated to protect their land from the harmful effects of the climate change if possible and they will aim to improve upon their already existing situation.

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