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Bulletin of Agri-ecology, Agri-food, Bioengineering and Agritourism

Biodiversity

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Sanogeneous Food

Sustainable Tourism and Hospitality

Ideas and Concepts

News



EcoAgriTourism, in the light of its multidisciplinary character, is a wide-open journal which brings together the opinions of specialists from both academic and economic environment, fostering fruitful collaborations.

The journal's structure covers all aspects of the fields approached, the focus being on original and current researches with applications in agriculture, food industry and rural tourism. Collaborators may feel free to undertake biological and technical aspects as well as aspects with social, cultural and environmental impact. Information of general interest is also welcome for the agriecology-food-tourism axis.

Prof. Romulus Gruia Ph. D.

The Journal of EcoAgroTurism aims at approaching analyses, methodologies, options and references within the journal's framework.

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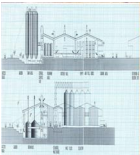


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## Editorial Column

### **”CRUISES IN DRACULA’S LAND”**

To boost the development of tourism industry in Romania we believe that cruise tourism can be a solution, considering that it represents a potentially very less exploited.

The importance in the cruise circuit is even greater as it can be linked to other types and forms of tourism during stopovers in the ports of the Black Sea or the Danube.

A possible complementarity, for example, is that from Constanta by plane or coaches to come to Brasov to visit the "land of Dracula" and then return, all in reasonable time and in terms of comfort, then will continue the cruise.

In this context between 9 and 11 March 2012 it will be held in Brasov an international seminar on "**Cruises in Dracula’s Land**".

This scientific event on cruises in the tourism industry and the marketing cruise information dissemination will be organized in partnership with CROAZIERE.NET and Department of Food and Tourism at the University of Braşov.

The main objectives of the seminar are:

1. Travel agencies disseminate ways of promoting and selling cruises in the Romanian market;
2. Realization of a complex tourism program of connection between tourism and local tourism cruise from the Carpathian area, targeting a complementary cruise tourism program in Romania;
3. Networking between tourism industry structures and specialized trainers in higher education;
4. Identification of opportunities for developing programs intersheep between students of the Faculty of Tourism and Food and cruise lines.

Among participants who announced they arrival, we mention: Mr. Bernie Blomquist - CLIA training academy director, Mr. Giovanni Ponticelli – commercial director emerging markets MSC Cruises, Mrs. Chiara Brambilla - commercial director on Europe Carnival Cruise Line, Mr. Steve Garrod - sales manager Holland America Line.

Also with the participation of undergraduate and graduate students from the Faculty of Food and Tourism from Transilvania University of Brasov, but also from Babes-Bolay in Cluj and the University of Craiova.

Are expected over a hundred representatives of travel agencies interested in selling cruises.

Professor Romulus GRUIA, PhD  
Director of the Journal of EcoAgriTourism



## INFLUENCE OF CULTURE TECHNOLOGY ON POTATO MINITUBERS PRODUCTIVITY

ANDREEA NISTOR\*    NICOLETA CHIRU    S. RUSU

**Abstract:** *Minitubers, which are produced from in vitro tissue cuttings, are completely pathogen free. The use of tissue culture methods has greatly facilitated the production process of pathogen-free potato seed. Potato cultivars were grown at three different densities (8; 6; 5 minitubers/ linear meter). The best productivity was obtained at 8 minitubers/ linear meter (28,24 t/ha). We studied 4 different cultivars of early, mid early and semitardive: Ostara, Christian, Roclas, Desiree, Roclas presented the best production (28,93t/ha); we compared fraction <25 mm, from the greenhouse with 25-35mm.*

**Keywords:** *minitubers, tunnels “insect proof”, planting density, planting size, production*

### Introduction

Producing minitubers from *in vitro* plantlets allows a faster multiplication rate in seed programs and reduces the number of field generation needed (Ranalli, 1997).

In the common environment conditions, potato is infected with 25 viruses and 1 viroid (Salazar, 1996). Most severe viruses, which produce disease and strong affecting of potato plants, eventually leading to important losses of production (Boțoman, 2005). Producing minitubers from *in vitro* plantlets allows a faster multiplication rate in seed tuber production programs and reduces the number of required field generations (Imma and Mingo- Castel, 2006). These minitubers are the beginning stage of seed potato production. The application of healthy potato tubers will lead to at least 30% yield increase (Zarghami, 2001).

Production of minitubers is a fully controllable method of obtaining of a pathogen-free nuclear stock from tissue cultured clones of potato varieties in a biomanufacturing facility.

The size of mini-tubers may range from 5-25 mm although in current systems larger minitubers also have become common. This size range coincides with a weight range of 0.1-10 g or more (Struik, 2007).

Planting density variations could influence above- and belowground biomass accumulation and, subsequently, tuber number and weight. Karafyllidis et al. (1997) determined that more

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high planting densities in contrast with low densities. Another study showed that increasing planting densities reduces the proportion of large minitubers in favor of more small minitubers (Georgakis et al., 1997).

On this study, minitubers, were planted on high altitudes and these represent the existence of natural barriers create on natural conditions for isolating crops and therefore reduce virotic disease propagation (Bozeșan, 2003).

Development of applied research in the production of potato planting material by developing concepts and methodological solutions must represent a bridge between the potato crop in Romania and crop, with a very large impact on economic and social standards exhibited by European Union.

### Materials and method

In 2009, was done in Lazarea, District Harghita a productivity study of potato (both in free and in tunnels “insect proof”), obtained from minitubers.

In the experimental field from Lazarea, was placed a polifactorial experience, on the type 2x4x3x2, located by the method subdivided parcels with a total of 48 variants studied in three repetitions.

Factors investigated:

-Factor A: The experiment with two graduations:

-a1 - experiments in field

a2 - experiments in tunnels

- Factor B: Cultivars with 4 graduations:
  - b1- Ostara
  - b2- Christian
  - b3- Roclas
  - b4-Desiree
- Factor C: planting density, with three graduations:
  - c1- 114. 285 minitubers / ha (70 x 12.5) = 11.4 pl/m<sup>2</sup> (8 minituber/ linear meter)
  - c2- 86 .058 minitubers / ha (70 x 16.6) = 8.6 pl/m<sup>2</sup> (6 minituber/ linear meter)
  - c3 - 71. 428 minitubers / ha (70 x 20.0) = 7.1 pl/m<sup>2</sup> (5 minituber/ linear meter)
- Factor D: Minitubers size used in planting, with two graduations:
  - d1: <25 mm
  - d2: 25 - 45 mm.

The climate is wet and cool, on closed areas, the largest amounts of precipitation falling in

June, July, August, with a high frequency of rainy days in July and August.

The average annual temperature is between 5, 6 to 7.5 - 7, 8 degrees Celsius.

Biologic material used in the experiment consisted of four varieties Ostara, Christian, and Desiree Roclas.

Other materials: minitubers of the two size fractions, fertilizers, herbicides, fungicides, insecticides, mesh "insect proof".

### Results and discussion

Experience in 2009, examined both tunnels "insect proof" and free field included study of several variables.

In case of cultivation influence, shows that higher yields were obtained in open field cultivation; in the tunnels "insect proof" the difference is statistically significant negative, this is being 5.23 t / ha (table 1).

Table 1

*The influence of culture technology on production (t/ha) of tubers obtained*

Culture technology	Production		Dif. (t/ha)	Significance
	(t/ha)	%		
Free field (Ct)	28,44	100,00	-	-
Tunnels "insect proof"	23,21	81,61	-5,23	ooo

LSD 5% = 1,35 (t/ha)      LSD 1%= 2,21 (t/ha)      LSD 0,1%=3,55 (t/ha)

Another factor examined was used the plant density (table 2). If is taking into account the density of 5 tub./linear meter (control) the results of statistical analysis indicated significant

differences in density of 8 tub./linear meter distinct significant from 6 tub./linear meter (4.98 and respectively 2,63 t/ha).

Table 2

*Influence of planting density on production (t/ha) of tubers obtained*

Number of minitub/ linear meter	Production		Dif. (t/ha)	Significance
	t/ha	%		
5 (Ct)	23,29	100,00	-	-
6	25,89	111,34	+2,63	**
8	28,24	121,24	+4,98	***

LSD 5% = 1,50 (t/ha)      LSD 1%= 2,17 (t/ha)      LSD 0,1%=2,71 (t/ha)

Table 3

*Influence of selected varieties on production (t/ha) of tubers*

Variety	Production		Dif. (t/ha)	Significance
	t/ha	%		
Ostara (Ct)	22,40	100,00	-	-
Christian	28,25	126,11	+5,85	***
Roclas	28,93	129,15	+6,53	***
Desiree	23,72	105,89	+1,32	irrelevant



LSD 5% = 1,78 (t/ha)    LSD 1% = 2,15 (t/ha)    LSD 0,1% = 3,39 (t/ha)

Analysis of the varieties used in the experiment (table 3) shows that the best results were obtained for Roclas with an average of 28.93 t / ha and Christian with 28.25 t / ha. The statistical

interpretation of the results shows significant differences for the two varieties mentioned above (respectively 6.53 and 5.85 t / ha).

Table 4  
*Combined influence of technology and planting density on production (t/ha) of tubers obtained*

Culture technology/ minitub no./linear meter	Tunnels "insect proof", a1			Free field, a2			Dif. (t/ha) a2-a1
	Prod. (t/ha)	Dif. (t/ha)	Semnif.	Prod. (t/ha)	Dif. (t/ha)	Semnif.	
5 (Ct)	20.58	-	-	26.12	-	-	+5,54 ***
6	23.09	+2,51	**	28.70	+2,58	**	+5,61 ***
8	25.99	+5,41	***	30.50	+4,38	***	+4,51 ***

LSD 5% = 1,22 (t/ha)

LSD 1% = 1,94 (t/ha)

LSD 0,1% = 2,82 (t/ha)

LSD 5% = 1,44 (t/ha)

LSD 1% = 2,67 (t/ha)

LSD 0,1% = 3,74 (t/ha)

In case of the influence of two factors such as growing conditions and planting density differences are very significant assured and respectively distinct significant for densities of 8 and 6 tubers/linear meter because yields are

higher compared with control (5.41 t / ha to the cultivation in tunnel and 4.38 t/ha for the growing on free field) for the density of 8 tubers/linear meter (table 4).

Table 5  
*Combined influence of variety and technology on production (t/ha) of tubers obtained*

Culture technology/ Cultivar	Tunnels "insect proof", a1			Free field, a2			Dif. (t/ha) a2-a1
	Prod. (t/ha)	Dif. (t/ha)	Signif.	Prod. (t/ha)	Dif. (t/ha)	Signif.	
Ostara, b1 (Ct)	20.98	-	-	23.84	-	-	+2,86 *
Christian, b2	24.76	+3,78	***	31.75	+7,91	***	+6,99 ***
Roclas, b3	23.78	+2,80	***	34.07	+10,23	***	+10,29 ***
Desiree, b4	23.35	+2,37	**	24.09	+0,25	irreleva nt	+0,74 irrelevant

LSD 5% = 0,92 (t/ha)

LSD 1% = 1,57 (t/ha)

LSD 0,1% = 2,37 (t/ha)

LSD 5% = 1,81 (t/ha)

LSD 1% = 2,87 (t/ha)

LSD 0,1% = 3,92 (t/ha)

In case of combined influence of the cultivar and technology conditions can be said that the production differences are very significant assured for Roclas and Christian cultivars in both types of technology (10.23 t / ha on free field and respectively and 7.91 t/ha) (table 5).

Statistical analysis of the three factors influence the planting density, cultivar and technology

conditions show that results on open-field culture are very significant differences assured for Roclas and Christian cultivars. Christian cultivar made a very significant difference 4.90 t / ha for technology on the tunnel and Roclas cultivar recorded a very significant difference of 13.02 t / ha (table 6).

Table 6

Combined influence of planting density, technology and variety over production (t/ha) of tubers obtained (Lăzarea, District Harghita, 2009)

Culture technology	Minitub no./linear meter	Cultivar			
		Ostara, b1	Christian, b2	Roclas, b3	Desiree, b4
Tunnels "insect proof", a1	8, B1	22,92 -	27,82 +4,90 **	25,71 +2,79 *	27,51 +4,59 **
	6, B2	20,53 -	24,60 +4,07 **	24,51 +3,98 **	22,73 +2,20 irrelevant
	5, B3	19,50 -	21,87 +2,37 irrelevant	21,13 +1,63 irrelevant	19,80 +0,30 irrelevant
Free field, a2	8, B1	27,37 -	32,64 +5,27 ***	35,21 +7,84 ***	26,77 -0,6 irrelevant
	6, B2	24,26 -	31,74 +7,48 ***	34,07 +9,81 ***	24,72 +0,46 irrelevant
	5, B3	19,90 -	30,86 +10,96 ***	32,92 +13,02 ***	20,79 +0,89 irrelevant

LSD 5% =2,51 (t/ha) LSD 1%= 3,81 (t/ha) LSD 0,1%=4,91 (t/ha)

### Conclusions:

Implementation of the tunnel "insect-proof" should be regarded as an effective solution to keeping quality pre-basic plant material and in an economically efficient solution and competitive nationally and internationally.

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## CURRENT LEGAL ISSUES REGARDING THE MEDICINAL PLANTS MARKET ORGANIZATION IN ROMANIA

Cristina FLOREA\*

**Abstract:** *The paper presents some aspects of national and European legislation regarding the medicinal and aromatic plant market organization in Romania, concerning their production and processing. The obtaining of raw materials for processing and their conversion into products that are sold such as: medicines, cosmetics, nutritional supplements or food additives and flavoring are envisaged. One aspect highlighted in the paper is the authorization procedure for placing on the market of the final products obtained from medicinal and aromatic plants. Some extracts of these plants are used for preparing food supplements and traditional medicines. Another issue revealed is the particular law provisions applied to the food supplements, herbal medicines with traditional use and the medicines which contain vitamins and minerals derived from plants. It is noted that national legislation can be improved for full harmonization with the European one.*

**Keywords:** *medicinal and aromatic plants, authorization procedure, nutritional supplements, vitamins and minerals.*

### 1. Introduction

EU member state since 2007, Romania is in the process of harmonizing national legislation with the EU in terms of production, processing and market organization of medicinal and aromatic herbs.

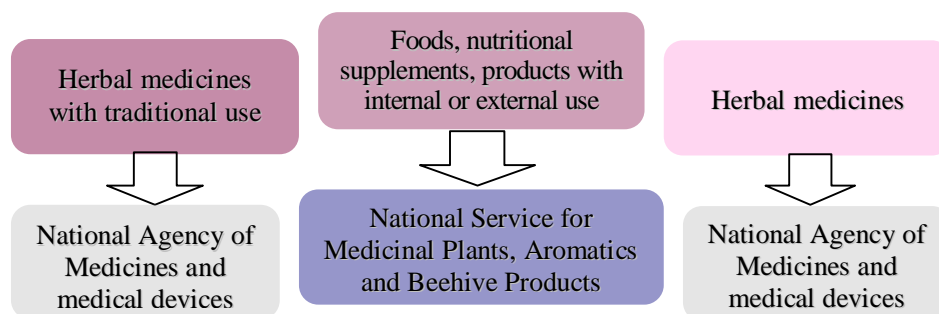
For the purposes of the Law no. 491/2003, republished on 20 January 2011 regarding the medicinal and aromatic plants, *production* represents the obtaining of medicinal and aromatic plants by growing or harvesting from spontaneous flora. *Remaking* is the conditioning of the medicinal and aromatic plants in teas, natural spices, and in raw materials for processing. *Processing* represents transforming the raw materials obtained by remaking into products that are marketed: medicines, cosmetics, nutritional

and dietary supplements, and flavoring food additives [7].

Marketing of fresh and processed medicinal and aromatic plants is based on technical standards developed according to the best practice guide for cultivating medicinal and aromatic plants as well as to the good practice guide for harvesting medicinal and aromatic plants from spontaneous flora, the compliance with rules being determined by certification bodies accredited for this purpose.

### 2. Material and method

The authorization procedure for placing final products obtained from medicinal and aromatic plants on the Romanian market is shown in Figure 1.



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Fig. 1. *The authorization procedure for final products based on medicinal plants*

Some **herbal extracts** are used in food supplements but also for the preparation of traditional medicines based on herbs. From this point of view there is a different approach in European legislation relating to the placing on the market of products based on plant extracts, due to specific rules and procedures used to obtain food or medicines.

Food supplements containing other substances than vitamins or minerals are considered food in the Community legislation, as defined by Regulation (EC) no.178/2002 of the European Parliament and of the Council, which states that the *food means any substance*

*or processed product, partially processed or unprocessed, intended to be ingested or reasonably likely to be ingested by humans* [13].

Due to the free movement of foodstuffs in the European Union, to protect health and life of citizens, the safety assessment of food consumption before they are placed on the Community market is a key issue.

By harmonizing the national legislation with Community one, food supplements as foodstuffs are regulated by food specific legislation and also by the legislation applicable to medicines. Figure 2 shows the national legislation applicable to final products based on medicinal plants.

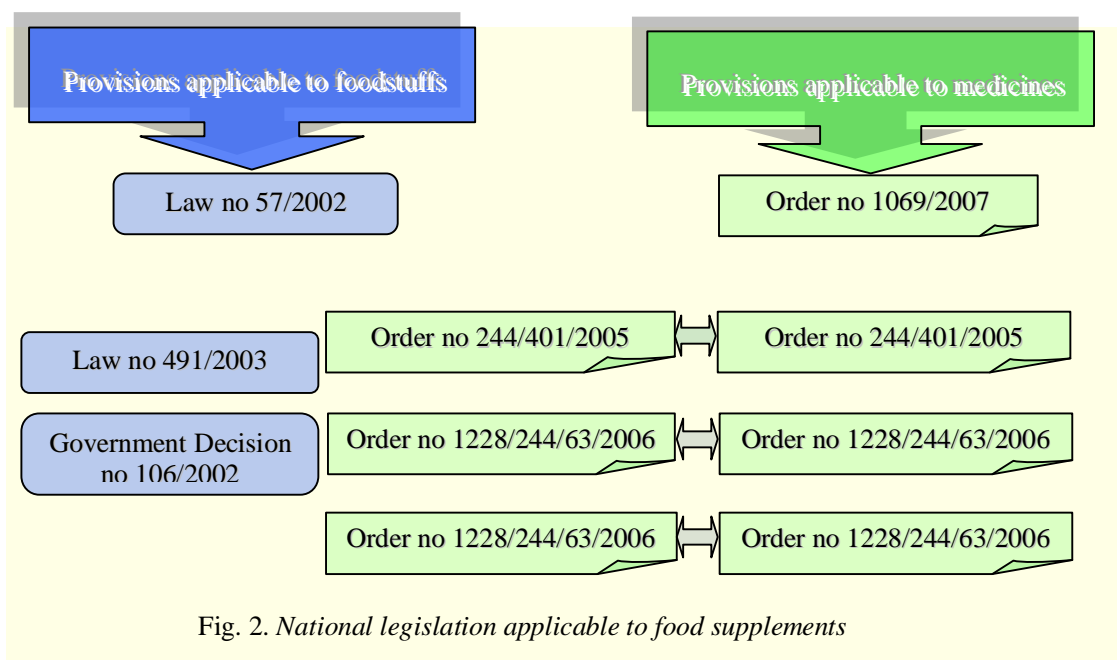


Fig. 2. *National legislation applicable to food supplements*

There are **special provisions** applicable to medicines with traditional use based on herbal plants. Thus, in the Law 95/2006 on health reform a simplified procedure for authorizing the placing on market of herbal medicine with traditional use is established.

The file submitted for approval to the competent authority should be provided with evidence to support the traditional use of herbal medicines to fulfill specific and appropriate standards of safety and quality.

For herbal medicinal products as defined in Law 95/2006 on health reform, like *any medicine containing as active substances exclusively one or more substances or preparations of vegetable plants, or a combination of one or more of those*

*vegetable substances or preparations of plants*, a simplified procedure for marketing authorization can be applied, by derogation from art. 695 point 31, if for the safety of vitamins and minerals present in herbal medicines there is a well documented prove, and if the action of vitamins and minerals is ancillary to that of the active ingredients from plants, compared to the claimed indication [8].

Concerning the use of other substances than vitamins and minerals in food supplements, a European Commission report drafted in 2008 stated that the market for food supplements containing other substances is a heterogeneous market, being extremely diversified in terms of

substances used, and also in terms of traditions into different European Member States.

**Directive 2002/46/EC** of the European Parliament and of the Council of 10 June 2002 on the approximation of the laws of the Member States relating to food supplements sets only the rules for use of vitamins and minerals in production of food supplements and carry out a **partial harmonization** of rules for the food supplements marketing.

As a consequence, *using other substances than vitamins or minerals in the production of food supplements is currently regulated by national legislation of each Member States up to the final harmonization with the Community laws.* Most of the Member States have established positive or negative lists for other substances than vitamins

and minerals which can be used in food supplements. In certain cases, the use of those substances must comply with technical requirements such as maximum limits, type of extract or combination of ingredients.

**Regulation EC 1924/2006** of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods requires manufacturers to provide scientific evidence to prove the benefits listed on the label and in advertising, the European Food Safety Authority (EFSA) being the body empowered to decide whether such claims are credible, related to therapeutic effects.

Summarized, Community legislation regulating herbal final products is presented in Table 1.

Table 1

*European norms for the final products based on plants*

Provisions applicable to foodstuffs	Provisions applicable to medicines	Provisions applicable to medicines with traditional use
Directive 2002/46/EC	Directive 2001/83/EC	Directive 2004/24/EC
Regulation EC 178/2002	Regulation EC no 1925/2006	
Regulation EC no 258/1997	Regulation EC no 1331/2008	
Regulation EC no 1924/2006		
Directive 2008/100/EC		
Regulation EC no 1170/2009		
Regulation EC no 1334/2008		
Directive 2000/13/EC		

### 3. Conclusions

- Community regulations and national ones regarding to the final products derived from plants have been developed for the safety of citizens, scientific evidence required for marketing authorization of products that are marketed as beneficial for health, lodge the security of their quality.

- In order to not mislead consumers, by regulations on labeling, manufacturers of dietary supplements and other final products from plants classified by law as a food product must not attribute them the action to prevent, treat or cure a human disease or refer to such properties.

- By compliance with those regulations is intended to avoid selling doubtful products, invalidated scientifically, which may endanger the lives of consumers.

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1. Commission Directive 2008/100/EC of 28 October 2008 amending Council Directive 90/496/EEC on nutrition labelling for foodstuffs as regards recommended daily allowances, energy conversion factors and definitions.
2. Commission Regulation (EC) No 1170/2009 of 30 November 2009 amending Directive 2002/46/EC of the European Parliament and of Council and Regulation (EC) No 1925/2006 of the European Parliament and of the Council as regards the lists of vitamin and minerals and their

forms that can be added to foods, including food supplements.

**3.** Directive 2001/83/EC of the European Parliament and of the Council of 6 November 2001 on the Community code relating to medicinal products for human use.

**4.** Directive 2002/46/EC of the European Parliament and of the Council of 10 June 2002 on the approximation of the laws of the Member States relating to food supplements.

**5.** Directive 2004/24/EC of the European Parliament and of the Council of 31 March 2004 amending, as regards traditional herbal medicinal products, Directive 2001/83/EC on the Community code relating to medicinal products for human use.

**6.** Government Decision no 106 of 07 February 2002 on food labeling, as amended and supplemented, published in Official Gazette no 147 of 27 February 27 2002.

**7.** Law no 491/2003 on medicinal and aromatic plants and hive products, republished in the Official Gazette no 52 of 20 January 2011.

**8.** Law no 95/2006 on health reform.

**9.** Order no 244/401/2005 for remaking, processing and marketing of medicinal and aromatic plants used as such, partially processed under the form of pre-measured food supplements, published in Official Gazette no 456 of 30 May 2005.

**10.** Order no 1228/244/63/2006 for the approval of technical norms on marketing pre-measured food supplements for animal and vegetable and /or their mixtures with vitamins, minerals and other nutrients, published in Official Gazette no 253 of 21 March 2006.

**11.** Order no 1069 of 19 June 2007 on approval the norms concerning food supplements, published in Official Gazette no 455 of 5 July 2007.

**12.** Regulation (EC) No 258/1997 of the European Parliament and of the Council of 27 January 1997 concerning novel foods and novel food ingredients.

**13.** Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

**14.** Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods.

**15.** Regulation (EC) No 1925/2006 of the European Parliament and of the Council of 20 December 2006 on the addition of vitamins and minerals and of certain other substances to foods.

**16.** Regulation (EC) No 1331/2008 of the European Parliament and of the Council of 16 December 2008 establishing a common authorisation procedure for food additives, food enzymes and food flavourings.

**17.** Regulation (EC) No 1334/2008 of the European Parliament and of the Council of 16 December 2008 on flavourings and certain food ingredients with flavouring properties for use in and on foods.

**18.** <http://www.ms.gov.ro>.

**19.** <http://www.anpc.gov.ro>.

**20.** <http://www.efsa.europa.eu>.

**21.** <http://www.coe.int>.

**22.** <http://eur-lex.europa.eu>.

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## PRELIMINARY RESEARCHES ON USING SPICES IN TRADITIONAL BAKERY PRODUCT RECIPES

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L. GACEU\*\*

**Abstract:** *The paper present preliminary researches regarding the possibility of using different spices in bakery recipes. The main goal was to evaluate the preservation attributes trough inhibition of *Aspargillus flavus*. Meantime some conclusions were made upon the inhibition of leaven for some types of spices.*

**Keywords:** *Spices, chili, capsaicin, asthma, cholesterol, chronic bronchitis, saffron, mold, *Aspargiflus flavus*;*

### 1. Introduction

Spices have been used for thousands of years in Europe and Asia, being important ingredients not only for the food, but also for the consumers.

Spices make food not only healthier but also tastier. According to the researches and clinical trials it was proved that the addition of spices has not only beneficial influences on digestive and metabolic activities, but also on cardiovascular activities. Currently in our country there are used over 20-30 types of spices. In the world are about a thousand. In herbal stores, in aromatics from our country are used about 40 spices. These spices, in their totality are considered herbs, so the problem is not whether we use them or not, but how we use them. Below are mentioned a few qualities of spices.

Hot spices (the spicy tasted ones: black pepper, paprika, curry, cinnamon, cloves, etc.) are recommended for people with a calm temperament and melancholic. Excess of hot spices is not recommended for people with hypertension and those with spicy food allergies.

Over time people have been adding spices to food to give them a better taste. The Egyptians basic food was bread and other products of flour, preparing more than 40 types of bread to which they added different ingredients and spices.

Ancient Romans ate many kinds of bread, prepared with milk or oil, with lard or spices, eggs or even raisins.

Once, spices were even more expensive than gold, like saffron, and were used in trade like currency.

### 2. Influence of spices in consumers health

**2.1. Paprika** - is rich in vitamin C, being very helpful in cases of coughing, and using a few seeds pressed into shoes, helps warming up feet in winter. Although many doctors say that hot pepper is not healthy to people with stomach problems, it was clinically proven that this spice does not erode the stomach lining and causes no further trouble.

The capsaicin substance from the hot pepper could stop and destroy the development of the bacteria responsible for the emergence of many ulcers. Hot pepper is not causing ulcer, but also it's not making it worse, but it's not curing it either. However, stomach burns can be accentuated with pepper consumption. Also it's very good in preventing heart diseases, being a mild anticoagulant.

Spicy foods help strengthening up the metabolism, burning extra calories. For people who suffer from asthma, chronic bronchitis, sinusitis and congestion caused by colds or flu, chili consumption is recommended because of its acts as an expectorant.

Capsaicin is the substance responsible for the extreme hot feeling that generates contact with oral mucosa. Capsaicin has the effect of reducing blood cholesterol levels, lowers blood pressure and stroke risk. Also the vasodilator effect is responsible for pain loss in areas that capsaicin cream is applied. Because all these benefic effects, it is recommended the use of hot pepper

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(implicitly capsaicin) in the forms of gels, creams or sprays on affected areas as well as hot pepper tinctures.

**2.2. Soffran** – has been studied by Chinese physicians since ancient times, being prescribed for stomach conditions.

Subsequent studies found that saffron is a very good antioxidant and has anti-inflammatory properties, helping also to prevent cancer. Due to its high volatile oil content, saffron offers antibacterial effects to the body, and doctors recommend regular consumption because it has been shown a significantly reduced risk of dementia.

**2.3. Cumin**– is very helpful in relieving morning sickness for pregnant women, and also it is a good natural laxative, helps with insomnia problems having soothing effects. Cumin seeds help in relieving cough and it is very good against sore throat.

**2.4. Basil** – prevents colds, reduces fever, relieves cough and decreases fating nausea, cystitis, muscle cramps, constipation and food poisoning. Regulates blood sugar, reduces motion sickness, prevents atherosclerosis, stimulates the immune system.

**2.5. Rosemary** – is not only a culinary herb, but it's also a real drug. After lavender, it is the most often used plant in aromatherapy for its qualities of removing tension and stress. The most important components of rosemary are the contained acids, which have antioxidant and anti-inflammatory properties, therefore the plant is effective in treating asthma, liver and cardiovascular diseases.

### 3. The technology used for the production of bakery products

#### 3.1. Description of working method

Since spices were used to improve the taste of food, it has been decided to make a study of their influence on the validity of food.

Using the bread machine Moulinex 573 804, were prepared several breads with different spices to see if it will influence in a positive way the validity of the bread.

Using the same program, same weights and the same raw material, there were prepared the following types of bread:

- Simple white bread;

- Bread with chili (2 little spoons of chili)
- Bread with cumin (2 little spoons of cumin)
- Bread with rosemary (2 little spoons of rosemary)
- Bread with basil (2 little spoons of basil)
- Bread with saffron



Fig.1. Bread machine Moulinex 573 804

#### 3.2. Preparation of a 500g bread:

- 190 ml of water
- 3,5 little spoons of oil
- 1 spoon salt
- 350 g flour
- 2,5 little spoons of sugar
- 1 little spoon of yeast
- + 2 little spoons of different spices

#### 3.3. Duration of program:

- 30 minutes preheating
- 5 minutes first kneading
- 5 minutes rest
- 15 minutes second kneading
- 49 minutes rest
- 10 second third kneading
- 25 minutes rest
- 10 seconds fourth kneading
- 45 minutes rest
- 46 minutes cooking

**Total:** 3 hours and 41 minutes

After a period of 4-5 hours of cooling, the bread can be sliced.

The bread is sliced and packed in plastic bags, paper bags and on a glass and stored in a place away from sunlight and moisture, to



observe in what bag and which one of the spiced breads influences the conservations. (fig. 2.)



Fig. 2. Different types of spiced bread in different package

#### 4. Results and coments

After a few days on the bread in plastic bags appeared the first strain of mold and the conservation was influenced by spices as it can be seen in the next table:

Spices	Appearance of the first strains of mold
Simple white bread	After 3 days
Chili	After 5 days
Cumin	After 9 days
Rosemary	After 4 days
Saffron	After 4 days
Basil	After 4 day

After 5 days, the simple white bread was fully covered with mold, like in Fig. 3 (microscope view)



Fig. 3. Strains of mold on the simple white bread

After a few tests at the Sanitary – Veterinary Direction from Brasov, made by Dr. V. Necula, on the simple white bread and on the one with chili, we observed that chili powder inhibits the development of *Aspargillus* gender as such was not presented in the seeded culture sample that was taken from the bread with chili, and the simple bread developed it.

Although the bread spiced with chili gowned mold 6 days later then the simple white bread, we assume that the chili powder inhibits the growth of some type of mold like *Aspargillus flavus*. (fig. 4.)

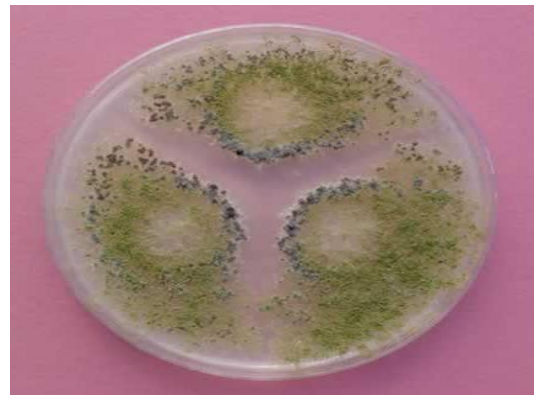


Fig. 4. *Aspargillus flavus*

#### 5. Conclusions

Spices substances have a great potential for use in the bakery area. Depending on the type of spices, the influence is referring to:

- the sensorial influence (taste and smell)
- inhibition of leaven with negative effect upon bread rising
- inhibition of *Aspargillus Flavus* rising with favorable effect upon the preserving of bread and bakery products

- healthy influence of the aromatics substances contained by spices.

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# THREATENED AMARYLLIDACEAE J. ST.-HIL. SPECIES FROM SPONTANEOUS FLORA OF REPUBLIC OF MOLDOVA: CONSERVATION AND SUSTAINABLE USE

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**Abstract:** *Plants of the Amaryllidaceae have attracted in recent years considerable attention due to their content of alkaloids with interesting pharmacological activities. It is one of the 20 most important alkaloid-containing plant families. They also represent a high decorative source of perennials used in floral arrangements, cut flowers and as pot plant for interior decoration.*

*These species were included in ex-situ collection of medicinal and aromatic plants in order to observe their reproductive behavior and accumulate experience on their agrotechnical peculiarities. Adult plants were transplanted from their native populations in 2005-2010 under similar ecological conditions.*

*Investigation includes propagation aspects, research into cultivation techniques and conservation measures. The biological particularities and the phenologic rhythm are also registered. All received data shows the ecological flexibility of species and the possibility of preserving them in culture.*

**Key words:** *Amaryllidaceae species, conservation, sustainable use, Republic of Moldova*

## 1. Introduction

In the last two decades plant diversity in the country has been facing increasing anthropogenic pressure which causes deterioration and loss of habitats and direct destruction of species populations by trampling, grazing, infrastructural development, stone-pitting, etc. It became urgently necessary to update and re-evaluate the risk of extinction for the species in the Moldavian flora.

One of the most threatened groups of higher vascular plants is *Amaryllidaceae* family. This family, worldwide consists of about 1100 species in 85 genera, and is distributed largely throughout the tropics and warm temperate regions of the world. There are five plant species of *Amaryllidaceae* growing in Republic of Moldova, namely: *Galanthus elwesii* Hook.fil., *G. nivalis* L., *G. plicatus* Bieb., *Leucojum aestivum* L., *Sternbergia colchiciflora* Waldst. et Kit. [8]. All these taxa are protected in our country and included in The Red Book of the Republic of Moldova [3].

Plants of the *Amaryllidaceae* have attracted in recent years considerable attention

due to their content of alkaloids with interesting pharmacological activities. It is one of the 20 most important alkaloid-containing plant families. Extracts from the plants are used in folk medicine for myopathy and diseases of the nervous system. Scientific investigations demonstrated antiviral [6], antibacterial [10], analgesic [13] and antihypertensive (hypotensive) [11] effects of the constituents of these plants. Recent studies showed also the antitumor properties of alkaloids isolated from *Amaryllidaceae* species, thus playing a crucial role in the future treatment of cancerous diseases.

Bulbous plants are requested in landscaping, improving stone and rock gardens. *Amaryllidaceae* family is also one of the largest groups of ornamental bulbous plants. They represent a high decorative source of perennials used in floral arrangements, cut flowers and as pot plant for interior decoration, balconies, terraces etc. [1, 2, 9, 12]. They can be placed in plant arrangements under the trees, in group with other ephemeroïd plants (e.g. *Crocus*, *Muscari*, *Scilla*, *Colchicum* etc.), as well as with some evergreen perennials

(*Vinca minor* “*Variegata*”, *Sedum hispanicum*, *S. lydium*, *S. brevifolium* etc.).

Our investigations were targeted to the evaluation of natural populations of studied species, identification of new locations as well as their *ex-situ* conservation.

## 2. Materials and methods

During the vegetation period of 2007-2010, series of expeditions have been organized in different parts of the country. The present state of their populations as well as new locations was assessed. In the course of terrain research the taxa found were recorded in lists, and in case of difficulties with the identification of the species in the field, the herbarium specimens have been collected. For laboratory identification were used the up to date scientific works [4, 5, 7, 8, 14].

The investigations regarding cultivation of these species were carried out at the experimental fields in the Botanical Garden. Adult plants were transplanted from there native populations under similar ecological conditions. Investigations include propagation aspects and research into cultivation techniques and conservation methods.

## 3. Results and discussions

Our recent field investigation concluded that biological indicators of populations (such as very few number of subpopulations, rapid decline in the number of mature individuals, which is essential for the state of geofit populations, or very small population size) are increasingly deteriorating and all these taxa became threatened with extinction. The results of terrain investigations and the review of scientific references allowed identifying the current status of these taxa and their population situations in native flora.

*Galanthus elwesii*, being Critically Endangered species, grows in a single location in the south of the country, in clear forests, especially in *Quercus pubescens* oak trees, bushes. The number of this plant does not exceed several dozens of mature individuals. It grows isolated or in groups. The only population has undergone a significant decline in the past, although there is a chance for it to be found in new locations.

*Galanthus plicatus*, a Vulnerable species, grows also in a single location in the south of the country, in clear forest of common oak with ash. The group of plant occupies an

area of about 1 ha. The number of flowering mature individuals per square meter is from 1 to 23. The only population is preserved in the landscape reserve “Codrii Tigheci” and if the available life conditions are preserved the plant population will be very viable.

*Galanthus nivalis*, also a Vulnerable bulbous plant, grows in a number of locations from the south-east through the central part to the north of the country, preferring the moist forests of common oak, preferably with lime and ash trees, rarely with pedicellate oak. Sometimes it forms a herbal cover in early spring. The populations of this species are quite stable and numerous. The number of plants is up to 20 mature individuals per square meter. The major threat for it is over collecting by population, although it is preserved in a number of scientific and landscape reserves.

*Leucojum aestivum* L. with a status of Endangered species, is known from two isolated locations in the west of the country (Valley of Prut River), inhabiting the forest of white poplar, the depressions with increased moisture. The spreading area is limited, approximate number of plants is about 300 mature individuals.

*Sternbergia colchiciflora* Waldst. et Kit., an Endangered species producing small bright yellow flowers at soil level in the autumn before the leaves come out, what happens only in spring. Historically it was known only from 4 localities in the south of the country: near village Copanca, Tighina county; Culma railway station, Lapushna county; communes Vinogradovca and Valeni, Cahul county. On the left bank of Dniester there is indication of one location – “Novo-Andrijashevka” reserve, Slobodseja county [3, 7]. All these records are of 40-50 years old. Due to the expansion of human settlements, species may have disappeared, as the recent search of this plant in known localities (conducted in 2007-2010) gave no results.

As a result of our terrain investigations a new location with well preserved steppe vegetation was found near village Merenii Noi, Anenii Noi county. This area of approximately 20 hectares is situated of about 15 km south of the capital Chisinau, on south-west oriented terraced hillside. In the past, steppe communities occupied about 2/3 of the Moldovan territory. Currently natural steppe communities have been preserved only in small and isolated areas. The status of flora

diversity of steppe ecosystems is unsatisfactory throughout the republic due to the excessive and unorganized grazing and the reduction of lands with steppe vegetation. This well preserved steppe community gives shelter to a possibly the only remaining population of *S. colchiciflora* Waldst. et Kit. in the flora of our country.

Recognizing the need for *Amaryllidaceae* species preservation it has been initiated a research program referring to their *ex-situ* conservation. The analyzed taxa were planted in the collections of the Botanical Garden in similar conditions of natural habitat. The *Galanthus* species have a preference of sunny and semi shade places, on a well drained, sandy and rich in humus soil. *Leucojum aestivum* was planted in quite moist and slightly shaded sites, in sandy, rich in

organic substances soil. The open, sunny, rich in humus, well drained and without excess of moist soil is a perfect site for the *Sternbergia colchiciflora*. For this species transplanting procedure has to be done in autumn. Adult plants transplanted from their native populations in the last decade of October developed very well. A total of the transplants survived until next season and they looked more vigorous than plants in the natural habitats.

The growth rhythm of these taxa is in a direct correlation with the environmental factors. The first phases of the plant development is variable, and depends mainly on temperature demand. For that reason, in the recent years we have observed some shift to the early start of flowering stage (tab. 1).

Table 1. Phenologic spectrum of some *Amaryllidaceae* species

Scientific name	January			February			March			April			May			June		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
<i>Galanthus elwesii</i> Hook																		
<i>G. nivalis</i> L.																		
<i>G. plicatus</i> Bieb																		
<i>Leucojum aestivum</i> L.																		

	<b>vegetative stage</b>
	<b>flowering stage</b>
	<b>fructification</b>

For example, for *G. elwesii* in 2010 and 2011 the flower bud forming begun in II-III decade of January, whereas in the natural habitats this happens at the end of March – early April. The flowering period of *G. nivalis* was noted 10-12 day earlier in comparison to the natural populations. Also was recorded a protracted flowering period due to higher amounts of rain and lower temperature in March-April period. It was observed that *S. colchiciflora* bloomed abundantly in the *ex-situ* conditions. Flowering period begins in the first decade of September and lasts for 26-30 day.

All these taxa can be multiplied by bulbs and seeds. Those propagated from seeds begin flowering on 3-4<sup>th</sup> year of growth. The first steps of testing included research on quality and viability of seeds. Best results were obtained when sown in autumn. Whereas

vegetative multiplication shown the best results when it was done in spring through transplanting mature bulbs, after flowering period. Transferring the bulbs in a new place every three years allow to avoid plant disease appearing. In our collection there has not been registered any diseased or damaged by insects plants.

#### 4. Conclusions

The field investigation concluded that biological indicators of populations are increasingly deteriorating and all these taxa became threatened with extinction. The *ex-situ* conservation in the Botanical Garden (I) of ASM is a significant way to preserve these endangered species and to accumulate experience on their behavior in culture conditions.

A new location for *Sternbergia colchiciflora*, with well preserved steppe vegetation was found, being probably the only remaining population of this species in our native flora.

Multiplication and agro-technical studies conducted on these species, which is a significant source of biological active substances with very relevant therapeutic effects, including anticancer activity, are also of great importance.

The status of endangered species forces us to continue research on agricultural features, medicinal properties and micro propagation *in-vitro*.

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## ESSENTIAL OILS OF ZINGIBER OFFICINALE AND ANGELICA ARCHANGELICA PLANTS

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Angela Marculescu<sup>(2)</sup>

**Abstract:** Most essential oils exhibit antibacterial, antifungal, antiviral, insecticidal and antioxidant properties. The aim of this study is the production and the measurements of antimicrobial, radical-scavenging and antioxidant activities of the essential oils of *Zingiber officinale* and *Angelica archangelica*. When *Angelica archangelica* essential oil exhibited activity against all the microorganisms, *Zingiber officinale* was not active against *P. aeruginosa*. The strongest radical-scavenging activity (DPPH or 2,2-diphenyl-1-picrylhydrazyl test) was shown by *Zingiber officinale* ( $IC_{50} = 2600 \mu\text{g.mL}^{-1}$ ).

**Keywords:** *Zingiber officinale*, *Angelica archangelica*, essential oil, antibacterial, antioxidant.

### 1. Introduction

A large number of plants have been evaluated for their potential biological and pharmacological activities (Bakkali et al., 2008; Burt, 2004). At the same time, food and cosmetic industry develop natural products as a response to the trend of consumers desiring fewer synthetic food additives and products with a smaller impact on the environment. COSMOS natural and organic standards, product of negotiations between six European cosmetic certification bodies (Soil Association, Ecocert, BDIH, Bioforum, Cosmebio and ICEA), delivers "BIO" certification when the proportion of biological agriculture-certified ingredients is above twenty percent (COSMOS std, 2010). In this context, the hydro-distilled essential oils (EOs) have attracted a great deal of scientific interest as a potential source of natural antioxidants and antimicrobial active compounds. Antioxidants are compounds or extracts that neutralize chemically products such as free radicals. The radical scavenging activity can be measured using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay (Safai-Ghomi et al., 2009). Besides antioxidant activity, essential oils or their component exhibit antimicrobial properties (Burt, 2004).

The aim of the study is the isolation of EOs from two plants, *Zingiber officinale* and *Angelica archangelica* and the characterisation of their antioxidant and antimicrobial activities potentially useful for food, nutraceutical or cosmetic applications.

### 2. Experimental study

#### 2.1. Materials and methods

##### 2.1.1. DPPH scavenging assay

The free-radical-scavenging capacity of EOs extracts was evaluated with the DPPH stable radical following the methodology described by Sanchez-Moreno et al., 1998. A methanolic solution (1mL) of the sample or of the standard BHA and BHT at various concentrations were added to 1,0 mL of DPPH<sup>\*</sup> solution and allowed to react at 40°C during 30 min. When DPPH<sup>\*</sup> reacts with an antiradical compound the hydrogen transfer reduces it to form DPPH-H. The radical DPPH<sup>\*</sup> absorbs at 517 nm while DPPH-H does not. After 30 min, the absorbance values were measured against the blank. The radical-scavenging activity (percent inhibition) was expressed as percentage of DPPH radical elimination calculated according to the following equation:

$$\text{Percent inhibition (\%)} = [(A_{\text{control}} - A_{\text{sample}})/A_{\text{control}}] \times 100$$

where  $A_{\text{control}}$  is the absorbance of the negative control and  $A_{\text{sample}}$  is the absorbance of the sample. The  $IC_{50}$  value, which is the amount of sample necessary to decrease the absorbance of DPPH by 50%, was calculated. The results were compared with 2 other antioxidants: the BHA and the BHT. The absorbance is measured at 517 nm by means of a spectrophotometer "mini UV 1240" Shimadzu.

##### 2.1.2. Antimicrobial activity

###### a. Strains and media

The bacterial strains *Escherichia coli* CIP 54.117 Institut Pasteur collection, gram negative, *Pseudomonas aeruginosa* PAO1 wt, gram negative, *Staphylococcus hominis* subsp.hominis

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CIP 81.57, Institut Pasteur collection, gram positive, *Staphylococcus simulans* CIP 81.64, Institut Pasteur collection, gram positive, *Salmonella enterica Sp Enteritidis* CIP Institut Pasteur collection, gram negative and *Salmonella enterica Sp Typhimurium* CIP Institut Pasteur collection, gram negative were employed in this study. Microorganisms were grown at 37°C in Luria Bertani broth.

### b. Disk diffusion method

Screening of EOs for antimicrobial activity is often realised by the disk diffusion method. Sterilized cellulose discs (Sensi-Disk, 6 mm) were inoculated with 20 µL of pure or diluted EO in DMSO and were laid on top of an agar plate recovered by 100 µL of 10<sup>6</sup> UFC/mL bacterial cultures. After 24 h at 37°C, the bacterial growth inhibition were evaluated by measuring the diameter of the disk diffusion

### c. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC)

The minimum inhibitory concentration is the lowest concentration of EO void of microorganism (bacteriostatic property). The minimum bactericidal concentration is the lowest concentration of EO required to kill microorganism. The MIC was evaluated by macrodilution and microdilution methods; for the macromethod, each EO was dissolved in Luria-Broth at 10%. Samples were prepared with 1 mL of sterile LB and 1 mL of diluted EO. 1 mL of the mixture was transferred into 1mL of sterile LB. These experiments were repeated from 5% to 0.03% final concentration in Luria-Broth. 20µL of a diluted bacterial culture at 1/10 were added. Samples were incubated 18h at 37°C. A culture

witness and a negative witness were also prepared and incubated in the same conditions.

For the micromethod, samples were prepared in 96-wells microplates. 200µL of diluted EO at 10% were added to 200µL of sterile LB. 200µL of the first mixture were transferred to the second. These experiments were repeated from 5% to 0.03% final concentration in Luria-Broth. 20µL of a diluted bacterial culture at 1/10 were added. The microplates were incubated 18h at 37°C. The wells absorbances were measured at 600 nm. For the measurements of the Minimal Bactericidal Concentration, 20 µL of each negative culture well were transferred in agar plate. The plates were incubated 18h at 37°C.

## 2.2. Results

### 2.2.1. DPPH scavenging assay

The free-radical-scavenging capacity of the two samples was determined by DPPH assay. The strongest radical-scavenging activity was shown by EO of *Zingiber officinale* (IC<sub>50</sub> = 2600µg.mL<sup>-1</sup>) compared to the standards BHA (IC<sub>50</sub> = 3.3µg.mL<sup>-1</sup>) or BHT (IC<sub>50</sub> = 6.5µg.mL<sup>-1</sup>). *Angelica archangelica*'s EO led to IC<sub>50</sub> = 6500 µg.mL<sup>-1</sup>.

### 2.2.2. Antimicrobial activity

#### a. Disk assay

Preliminary screening of the antimicrobial activity of the two EOs were performed against six bacteria; four gram negative, *E. coli*, *P. aeruginosa*, *S. enteritidis* and *S. typhimurium* and two gram positive, *S. hominis* and *S. simulans*. As can be observed in Table 1, the EOs exhibited activity against the microorganisms. The EOs of *Angelica archangelica* and *Zingiber officinale* similar activities against all the strains except *E. coli* and *S. hominis*, *Angelica archangelica* being the most active.

Table 1

Antimicrobial activity: Disk diffusion (mm)

Essential oil	<i>E. coli</i>	<i>S. hominis</i>	<i>S. simulans</i>	<i>P. aeruginosa</i>	<i>S. enterica</i>	<i>S. typhimurium</i>
<i>Zingiber officinale</i>	14	12	12	ND	10	11
<i>Angelica archangelica</i>	20	25	14	8	10	12

ND: not determined

### b. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) (Table 2)



Determination of the MIC and MBC by the tube dilution method confirmed the activity of *Zingiber officinale* and *Angelica archangelica*.

Table 2

Antimicrobial activity: minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC)

Bacterial strain	<i>E. coli</i>		<i>S. hominis</i>		<i>S. simulans</i>		<i>P. aeruginosa</i>		<i>S. enterica</i>		<i>S. typhimurium</i>			
	CMI	CM B	CMI	CM B	CMI	CM B	CM I	CM B	CMI	CM B	CMI	CM B		
<i>Zingiber officinale</i>	1,25	2.50*	>2,5	2,5*	5	>5	2,5	1.25*	-	5	5*	5	1.25*	5
<i>Angelica archangelica</i>	1,25	>2,5	2,5*	5	2,5*	2,5	5*	>5	1,25*	2,5	1,25	1,25	1,25	1,25

\* measures obtained with micromethod (microplates)

*Zingiber officinale* and *Angelica archangelica* are characterized by similar MIC and MBC values of 1.25% for *E. coli* and 2.5% for the two gram positive bacteria and for the two salmonella strains. The micromethod showed good correlation with the macromethod. This micromethod can be used for a large number of samples being simultaneously tested.

### 3. Conclusion

The radical-scavenging, antioxidant and antibacterial activities of *Zingiber officinale* and *Angelica archangelica* EOs were characterized. *Zingiber officinale* and *Angelica archangelica* EOs decreased the absorbance of DPPH by 50% with concentrations corresponding to 2600 µg.mL<sup>-1</sup> and 6500 µg.mL<sup>-1</sup> respectively. *Angelica archangelica* showed a large antibacterial spectra inhibiting the growth of gram positive and gram negative bacteria, while *Zingiber officinale* was not active against *P. aeruginosa* strain. Regarding the CMI and CMB values, the EOs samples can be introduced at a final concentration of 2.5% to preserve a manufactured product. A mixture of the both EOs may increase the preservation.

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## CONTRIBUTIONS TO THE STUDY OF INDIGENOUS SPECIES *PRUNELLA VULGARIS* L

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**Abstract:** The genus *Prunella* is widely distributed in Romania by its three species characterized by lack of volatile oil. In this study we continue our previous researches that have followed the distribution of some chemical substances groups in Lamiaceae family. In this way we studied the chemical composition of the indigenous species, *Prunella vulgaris* L. Chromatographic analysis of polyphenols such as rosmarinic acid and pentacyclic triterpene acids (such as ursolic acid) were carried out by TLC and HPLC-MS. Rosmarinic and ursolic acids are well known, not only as chemotaxonomic markers, but also for their therapeutic importance.

**Keywords:** *Prunella vulgaris* L., rosmarinic acid, pentacyclic triterpene acids.

### 1. Introduction

*Prunella vulgaris* L. is a small herb commonly distributed through meadows, hay, forest clearings, roadsides, valleys.

People know it as the field basil, wild basil, and heather. This herb belongs to the family of Lamiaceae (Labiatae) and it is known in France under the name of *Brunelle*, and in the United Kingdom and the United States of America: All-heal, self-heals, healing -all.

It occurs as a small herb, perennial, underground with a repent rhizomes that nourishes a wide selection of sterile or floriferous stems. These are ascending, four-edges, reddish, bearing petiolate leaves, placed opposite. At the end of the flower stems are formed spiciformis (odd) inflorescence consisting of approximately spherical blue-violet flowers. The fruits are brown tetraachene.

The vegetable product consists of the aerial plant flowering, *Prunellae herba*, and it is harvested during the summer in sunny days. This contains active polyphenols which are some ingredients of tannin type, flavonoids, polyphenol-carboxylic acids and derivatives (rosmarinic acid). In fact like most of the Lamiaceae the tannin present here is figured by oligomers, monomers of Gallic tannins formed from polyphenol-carboxylic acids and combinations thereof. The most convincing example is rosmarinic acid, also called "*Lamiaceae tannin*", which from a chemical point of view is caffeic acid ester with 2-hydroxy acid dihydroxy caffeic.

In addition to polyphenols, *Prunella vulgaris* L. also contains bitter principles, volatile oil, saponins and their aglicons, pentacyclic type triterpenoid acids (ursolic acid and oleanolic acid), coumarin (umbelliferone, esculetol), and aucubin not confirmed by more recent research. Of particular importance is the presence of polysaccharides, partially sulphated, "prunelina" acting antiviral (HIV).

In folk medicine this plant is used to treat digestive disorders, as an astringent, antidiarrhoeal, anti-inflammatory (ulcers), antihemorrhagic. Infusion of the plant is also indicated in respiratory and urinary tract diseases.

It is well known the plant's use in the treatment of inflammatory diseases of the mouth, throat, gingivitis, as a gargle. It is also used to treat coughs, hoarseness, asthma, tonsillitis and through compresses infusion in migraine. Febrifuge action is often mentioned in literature. It also cited the use of this plant as anti-gonorrhoeal and aphrodisiac.

The studies in recent years stress the importance of key active ingredients such as rosmarinic acid and ursolic and oleanolic acids and especially the actions induced by them: antioxidant, anti-inflammatory, antimutagenic, antimicrobial and antiviral and in particular the immunosuppressive, anticancer.

More research and action recently reported antihypertensive, hypoglycaemic, and anti-allergic actions of *Prunella vulgaris* L. extracts, with major implications for Phytotherapy. In addition to these important therapeutic properties, in France this herb is sometimes used as food, consumed in salads, soups (young leaves). It is

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also used for the preparation of some beverages and it is an excellent melliferous species.

Given the importance of possessing polyphenol fractions, respectively the rosmarinic acid and the triterpenoid, we have proposed the study of these compounds in *Prunellae herba* of indigenous origin.

## 2. Material and methods

*Prunella vulgaris* L. was harvested in the flowering phase in summer (June-August), in 2008-2009 from Agnita - Săituiș Spa (Sibiu county) and Durău (Neamt County), and was dried in monolayer, in the shadow.

2 g plant materials (*Prunellae herba*), powdered in a grinder, was successively extracted with methanol and dichloromethane for three time (3 x 30 mL solvent). The extracts obtained after filtration were evaporated and analyzed by TLC (thin layer chromatography) and HPLC.

Chromatographic conditions for thin layer chromatography (TLC) for rosmarinic acid: SiO<sub>2</sub> MN chromatoplates, 0.25 mm layer and the following solvent systems: toluene-ethylformate-formic acid (50:40:10), and toluene-ethyl acetate - acetic acid (50:40:10), the spray reagent: (NEU / NP) reagent for natural substances and PEG 4000; then the plates were examined under UV light,  $\lambda = 365$  nm. For ursolic and oleanolic acids were used: chloroform-methanol (97:3) as solvent system. Subsequently the plates were sprayed with H<sub>2</sub>SO<sub>4</sub> 50% followed by heating at 110-130 °C for 10 minutes.

HPLC conditions to determinate the rosmarinic acid: the Thermo-Finnigan Surveyor Plus chromatograph, Hypersil BDS C18 column (250 x 4 mm) (5  $\mu$  m). The mobile phase consisted of a 0.1% solution of acetic acid and methanol in a concentration gradient according to tab. 1. Mobile phase flow rate was 1 mL/min, injection volume 20 $\mu$ l and the column temperature = 48°C

Table1

*Mobile phase concentration gradient*

Time (minutes)	Mobile phase A acetic acid 0,1%	Mobile phase B methanol %
0	95	5
35	58	42
45	58	42
55	95	5

HPLC conditions to determinate the ursolic and oleanolic acids: Agilent 1100 Chromatograph, Phenomenex RP 18 column (250 x 4 mm) (5  $\mu$  m), mobile phase: methanol-phosphate buffer pH 2.8 = 85:15 (v / v); mobile phase flow rate = 1 ml / min, injection volume: 10  $\mu$ l.

The total triterpenoids was obtained through the usual method by extraction of the powdered

plant (*Prunellae herba*) in methylene chloride at reflux, followed by concentration at low volumes and precipitation in petroleum ether (fig. 1). After decantation and filtration, the precipitate was dried, resulting in a greyish product, lightweight and sticky.

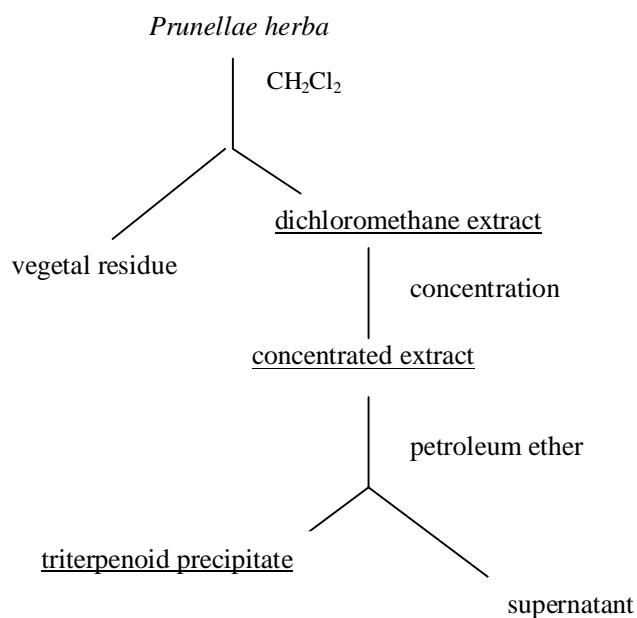


Fig. 1. The separation scheme of total triterpenoid

### 3. Results and discussions

TLC and HPLC analysis of methanolic extract of *Prunellae herba* showed a significant content of rosmarinic acid and, surprisingly, lack of or very low content of other polyphenolic compounds (fig. 2). As expected, in the dichloromethane extract is identified rosmarinic acid but lower compared with the methanolic extract.

Rosmarinic acid corresponding spot obtained by TLC and evidenced by NEU reagent showed under UV light ( $\lambda = 365 \text{ nm}$ ) a blue-green characteristic fluorescence; the identification of this compound is based on the comparison between the  $R_f$  values and the fluorescence of the rosmarinic acid, the reference substance (fig. 3).

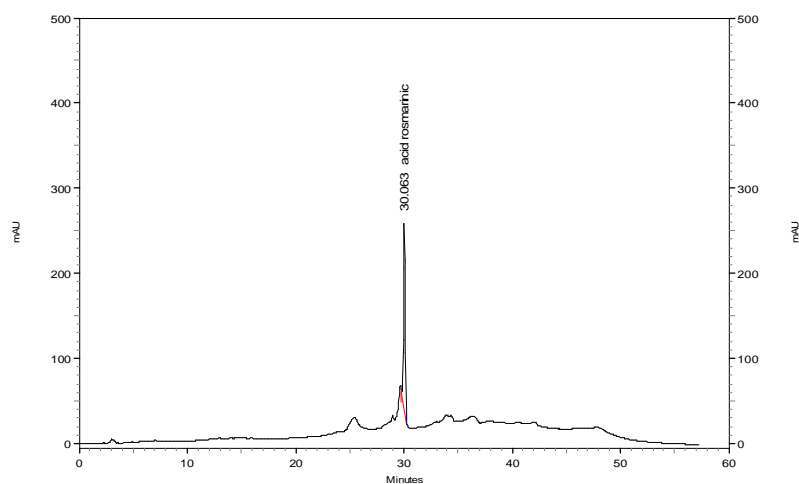


Fig. 2. HPLC analysis of methanolic extract of *Prunellae herba* for determination of rosmarinic acid

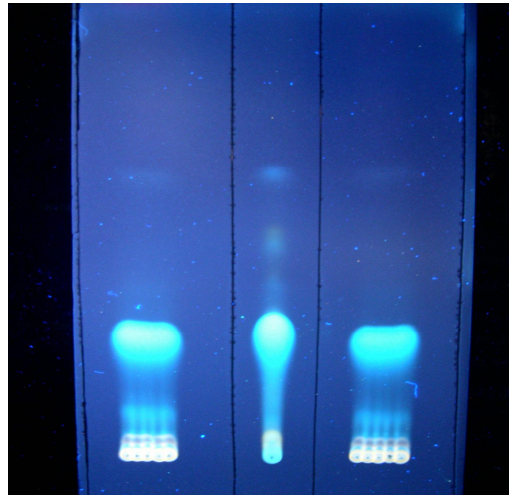


Fig. 3. TLC analysis of methanolic extract of *Prunellae herba* (1- MeOH extr; 2- rosmarinic acid; 3- MeOH extr.)

Analysis of dichloromethane extract by both TLC and HPLC show a more complex composition compared with the methanolic extract, identifying with the help of the reference

substances the ursolic and oleanolic acids (fig. 4). Of these, the ursolic acid is 3-4 times higher in quantities than oleanolic acid (fig. 4, fig. 5).

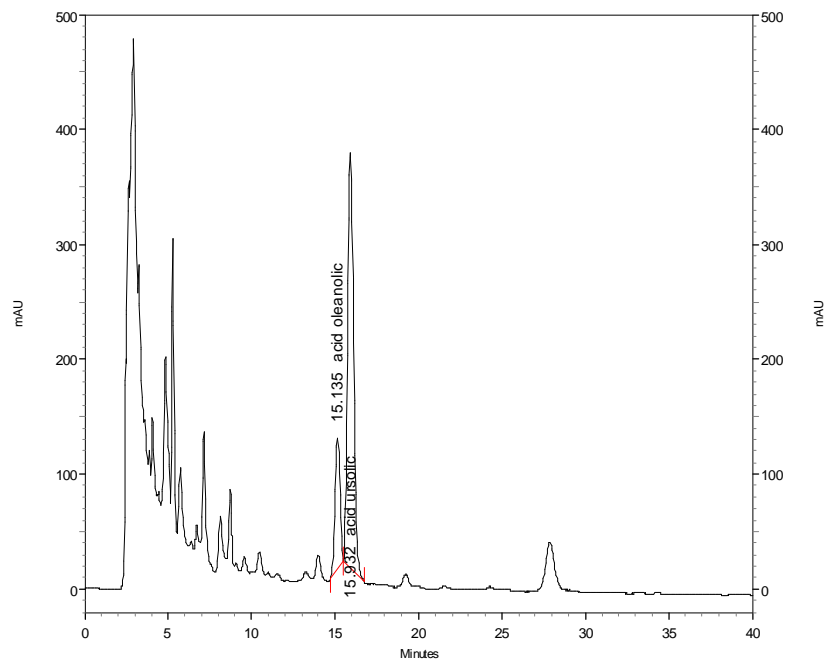


Fig. 4. HPLC analysis of dichloromethane extract of *Prunellae herba* for determination of oleanolic and ursolic acids

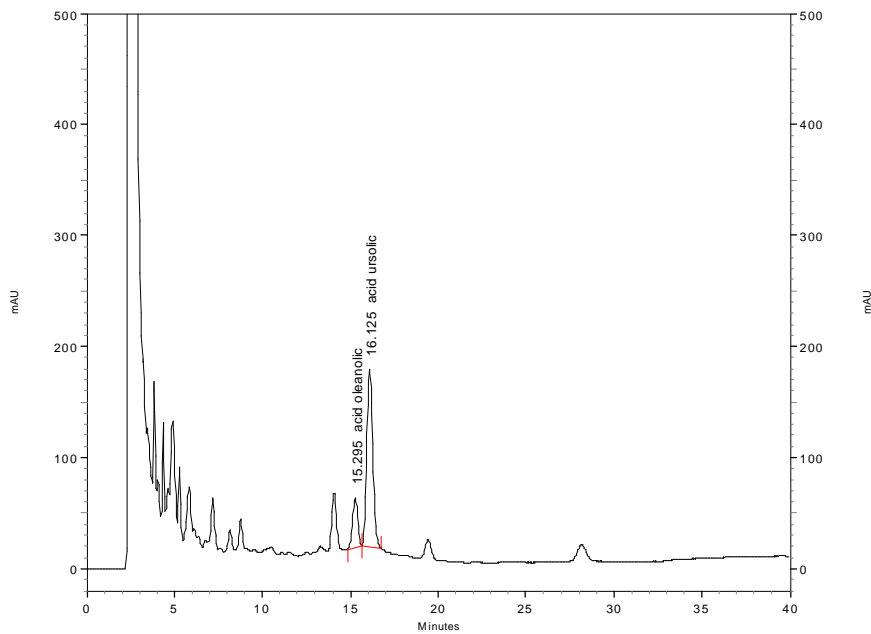


Fig. 5. HPLC analysis of methanolic extract of *Prunellae herba* for determination of oleanolic and ursolic acids

The separation of the two triterpenoid isomers, ursolic and oleanolic acids, is much better by HPLC, compared with TLC (fig.4, fig. 5, fig. 6). In addition to the two remember triterpenoids

acids, we can observe in both types of chromatography and the presence of other unidentified terpenoids compounds.



Fig. 6. TLC analysis of methanolic and dichloromethane extracts of *Prunellae herba* (1 - MeOH extr.; 2 - ursolic acid; 3-  $\text{CH}_2\text{Cl}_2$ extr.; 4-oleanolic acid)

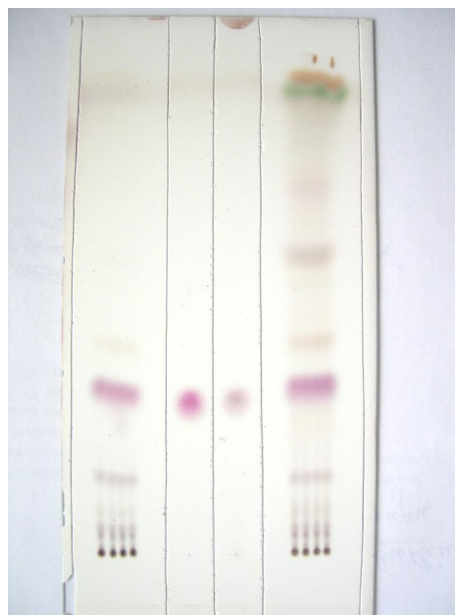


Fig. 7. TLC analysis of total terpenoid fraction (1- MeOH extr.; 2 - ursolic acid; 3- oleanolic acid; 4-  $\text{CH}_2\text{Cl}_2$ extr.)

The total triterpenoid fraction of *Prunellae herba* could be obtained from the extraction with dichloromethane and precipitated by petroleum ether. This CSS analysis confirmed the predominance of ursolic acid, among the terpenoids compounds from the plants (fig. 7).

#### 4. Conclusions

In this chemical study on the *Prunella vulgaris* L. we could find the following:

- plant widely distributed throughout the country, *Prunella vulgaris* L. is an important source of therapeutically active substances;
- CSS and HPLC chromatographic analysis showed a considerable amount of rosmarinic acid, a polyphenol with important therapeutic properties;
- there have also been reported appreciable amounts of pentacyclic triterpenoids acids, especially ursolic and oleanolic acids with the predominance of first;
- ursolic and rosmarinic acids have been confirmed as major active ingredients of *Prunella vulgaris* L., responsible for the pharmacodynamic actions reported for this plant.

As a conclusion, we can say that *Prunella vulgaris* L. proved to be a valuable medicinal species, awaiting the future therapeutic valorification.

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## PARTICULARITIES OF OIL EXTRACTION BY PRESSING HULLED AND HYDROTHERMALLY PROCESSED SUNFLOWER SEEDS

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**Abstract:** *The physical and chemical properties of sunflower oils have earned them a special position among foodstuffs, as they are a concentrated source of energy for the human body. Obtaining such oils, adequate both from a qualitative and quantitative perspective, greatly depends on the physical, chemical and biological characteristics of the processed raw materials, and even more so, on the extraction procedure. As regards sunflower, oil extraction by pressing hulled and hydrothermally processed seeds is the most common extraction method, the main characteristics, advantages and disadvantages of the same being analyzed and presented in this paper.*

**Keywords:** *sunflower, vegetable oil, pressing, hulling, hydrothermal processing.*

### 1. Introduction

On a worldwide scale, there appears to be an ever-growing need for vegetable oils, which is only understandable considering the advantages they present, from a dietary perspective, as compared to animal fats, namely:

- more easily assimilated (unsaturated fatty acids predominate over saturated fatty acids);
- superior, from a nutritional perspective, given the polyunsaturated fatty acid content;
- less impact on cholesterol levels;
- more fit for the preparation of certain foodstuffs (mayonnaise, sauces, dressings etc.).

Obtaining quality vegetable oils greatly depends on the physical, chemical and biological characteristics of the raw materials, as well as on the extraction procedure. Although numerous experiments are being conducted with the aim of developing the vegetable oils extraction method based on the use of supercritical fluids [10], at industrial level, in Romania, the separation of vegetable oils from oleaginous raw materials is being achieved by two procedures: expression (extraction by pressing) and solvent extraction, which can be applied independently or successively, depending on the oil content of the oleaginous raw material and the desired extraction degree.

The issue of vegetable oils extraction from oleaginous raw materials is quite topical nowadays, being a major concern both for specialists, who are permanently working on finding solutions intended to improve this process (increasing extraction efficiency, reducing energy consumption, introducing

various environmentally friendly technologies), but in the present situation, when the humanity is faced with a serious economic crisis, potential consumers seem to grow more and more concerned about this issue.

### 2. Materials and methods

The oleaginous raw materials are numerous and most varied. Of more than 100 species of oleaginous plants, on the world market there are presently about 40, grouped in 14 important botanical families [3, 6, 7], namely: compositae (sunflower), cruciferae (rape), leguminous plants (soya), malvaceae (cotton), papaveraceae (poppy), rozaceae (almond tree, hazel tree), peduliaceae (sesame), vitaceae (grape seed), jugladaceae (nut tree), palmae (oil palm, coconut palm, palm kernel), foleaceae (olive tree), linaceae (flax), leufobiaceae (castor oil plant) and solanaceae (tomato seeds, tobacco seeds) [3].

Due to their particular importance, oleaginous plants are being grown worldwide, the extent of each culture depending on the geographical area. Thus, if on a worldwide scale the palm tree holds the top position among the oleaginous raw materials, with 29.3% of the world vegetable oil production, in Europe, sunflower is ranked first, with 36.2% of the oil production, being closely followed by rape, with a share of 32.1%. In Romania, the mainly grown oleaginous plant is sunflower, with 78% of the domestic vegetable oil production. As far as the areas under cultivation are concerned, in 2010 Romania was



ranked first among the EU member states; however, the average yield per hectare remained by approximately 14% lower than the means on record in the other states of the European Union.

Considering the exceptional dietary qualities and the numerous industrial uses [12] of sunflower oil, and on top of that the prospect of using it on a large scale, together with the rapeseed oil, as a biofuel – biodiesel to be more precise [11], the materials which constitute the subject matter of this paper are the oleaginous sunflower seeds.

Sunflowers date back, according to archaeological evidence (carbon - 14 dating), about 4000...5000 years B.C. being originally grown in the basins of Mississippi and Missouri [11]. Brought to Europe in year 1510, sunflower was initially used as an ornamental plant in the gardens and parks of Spain, Portugal, France, Belgium and Germany. The first documentary evidence of sunflower seeds being used in Europe to obtain vegetable oil is patent number 408 of year 1716, taken out by Arthur Bunzan with the London Patent Office [11]. The sunflower started to spread as an oleaginous plant

as of year 1830, when the farmer of Russian extraction Bokarev, from the village of Alexeeva, region of Voronej, designed the first hand press for sunflower seed oil extraction. Towards the end of the 19<sup>th</sup> century, the sunflower plant is grown for the first time on the present territory of Romania, more precisely in Moldavia, where in year 1880, the first oil press for sunflower seeds was built somewhere close to Vaslui.

Sunflower seeds are achenes of variable dimensions (8...25 mm in length, 3.5...9 mm in width and 2.5...5 mm in thickness), generally in an elongated shape, pointed at the end attaching to the head. The chemical composition of the achenes is set forth in table 1, and they consist of a pericarp (hull), with a weight of 14...28% of the total weight of the seed (tab. 2), of a ligneous consistency, ashy, white, black-coloured or striped, and the oleaginous kernel, which can store up to 62...68% oil content [12].

As may be seen from the data contained in table 1, besides the high oil content, oleaginous seeds also contain significant quantities of protein substances, which is why sunflower is classified as a high-protein oil content plant.

Table 1

*Chemical composition of sunflower oleaginous seeds [3, 5, 6].*

DESIGNATION	VALUE
Humidity, %	9...11
Raw oil, %	44...48
Gross proteins, %	18...20
Non-nitrogenous extractive substances, %	10...15
Cellulose, %	14...18
Ash, %	2...3

Table 2

*Main characteristics of sunflower oleaginous seeds [2].*

DESIGNATION	VALUE
Hectolitre weight, kg/hl	38...42
Hull content, %	14...28
Equivalent diameter, mm	5.64
Density, kg/m <sup>3</sup>	730
Bulk density, kg/m <sup>3</sup>	438
Porosity index, %	40

To separate the vegetable oil from the sunflower seeds, the combined process is almost always used in industry practice, namely the pressing of the oleaginous material, which enables an oil separation of up to 80...85%,

followed by solvent extraction, whereby the remaining oil is being separated [6].

The combined procedure (expression-solvent extraction) is applied in the processing of oleaginous raw materials with a minimum oil

content of 30%. Raw materials with lower oil content are directly processed by solvent extraction, as the low yield of their expression does not justify the costs generated by this method [5, 6].

Depending on the characteristics of oleaginous seeds, the degree of equipment of the processing facilities and the desired extraction degree, there are 5 main categories of oleaginous material which can be subjected to extraction by pressing:

- oleaginous seeds as such (having reached technological maturity, dried but unshelled, ground or hydrothermally processed);
- ground unshelled oleaginous seeds;
- ground unshelled but hydrothermally processed oleaginous seeds;
- ground shelled oleaginous seeds;
- ground shelled and hydrothermally processed oleaginous seeds.

Considering the above, we may note that the grinding of oleaginous seeds is an omnipresent operation in the vegetable oil processing technologies (except for the first situation, very rarely met in current industrial practice on account of the low quality of the obtained oil). As regards the hulling of the oleaginous seeds and the hydrothermal processing of the ground seeds, although these perceived as optional operations, both the quality of oil and that of the resulting seed meal, as well as the enhancement of extraction yields, greatly depend on their application [10].

Due to their chemical composition characterized by a low botanical oil content (0.5...6%) and a high cellulose content (up to 60% in the case of sunflower seeds), the hulls of oleaginous seeds are an inert material in processing and unwanted in the composition of the seed meal. Therefore, as far as this is possible, hulls are partially eliminated by oleaginous seed shelling or hulling (a certain percentage of hulls – approximately 8...10% in the case of sunflower seeds – is not removed from the hulled material because it ensures optimal conditions for grinding and pressing). Considering that the hulling of oleaginous seeds involves two steps: cracking and separating the hull from the kernel, and separating the hulls from the resulting mixture, respectively, in order to obtain satisfactory results both from a technological and an economical point of view, only those oleaginous seeds with a high content of hull, which is loosely attached to the kernel

(sunflower, soya, castor oil seeds, cotton seeds, etc.) shall be put through a hulling process.

In the case of sunflower seeds, the main advantages derived from the hulling thereof lie in the:

- improvement in the quality of seed meal, by reducing the cellulose content and increasing the protein content: the seed meal obtained from unhulled sunflower seeds contains approximately 25% protein substances and 25...28% cellulose, that obtained from partially hulled seeds (10...12% hull remaining in the hulled material) contains 35...37% protein substances and 18% cellulose, while the seed meal obtained from mostly hulled seeds (6...8.5% hull remaining in the hulled material) contains 40...42% protein substances and 12...14% cellulose [3];
- increase in the processing capacity of the grinding rolls, of the hydrothermal processing facilities, of the pressing equipment, as well as of the extractors;
- reduction of equipment wear, especially on the grinding rolls and presses, given that the sunflower seed hull contains silicon dioxide, which is an abrasive material;
- reduction of oil losses occurring during the expression and solvent extraction processes;
- reduction of the wax content in the raw press oil (waxes, due to their high melting point, give to the oil a specific cloudiness – white sediments on the bottom of containers – for which reason these are being removed during the refining process through winterization);
- salvage of hulls and their use as fuel, in the manufacture of various products (furfural) or as an ingredient in forage for ruminants (ground hulls easily absorb molasses) etc.

The hydrothermal conditioning of the ground oleaginous seeds is an integral part of the material preparation operations preceding oil extraction by pressing and sometimes even solvent oil extraction, and it involves the performance of the following 2 operations:

- moistening the ground seeds up to an optimal humidity, specific to each oleaginous raw material;
- heating and drying the ground seeds until obtaining a specific cellular structure, enabling an easier oil separation during the process of extraction by pressing.

During the first stage, simultaneously with the feeding of the moistening agent (water spraying or steam injection in the hydrothermal processing system) the ground oleaginous seeds

are heated (in order to stop the enzymatic activity, favoured by the presence of water and who could cause and increase in oil acidity), operation which is continued in the second stage, during which the feeding of moistening agent is stopped.

Two phase result from the moistening of the ground oleaginous seeds: a solid phase (gel), consisting mostly of protein substances, with a marked absorbent character and a liquid phase, consisting of oil and water. Both components of the liquid phase are moistening the solid phase yet, given the fact that the superficial tension of water is higher than that of oil, it exerts a better moistening action, for which reason water intervenes between the solid phase and oil, thus reducing the forces retaining oil at the surface and in the open capillaries of the ground seed particles. At the same time, when soaked in water, the solid phase (proteins) increase their volume thereby causing a reduction in the diameters of capillaries and micro-capillaries of the ground seeds and thus forcing oil to surface. During the second stage, the heating of the ground seeds determines a drop in the superficial tension of oil but also a reduction in its viscosity, which makes it easier for the oil to be released from the closed capillaries of the ground seeds during the pressing process.

Although the hydrothermal processing of the ground oleaginous seeds is an extremely complex operation, which needs to be carried out under controlled conditions, through its application, due to the physical, chemical and structural transformations occurring in the oleaginous material, it becomes fit for extraction by pressing (forming an optimal cellular structure permitting to achieve maximum yields of oil on pressing).

After the grinding of the hulled oleaginous seeds and the hydrothermal processing of the resulting ground seeds, the technological process of vegetable oil extraction from sunflower seeds continues with the pressing of the hydrothermally processed oleaginous material. For that purpose, the oleaginous material heated at temperatures comprised between 80 and 95 Celsius degrees (in the case of sunflower seeds) can be transferred from the hydrothermal processing system directly inside the feeding vat of the pressing equipment. The results of the experimental researches have pointed out that in this temperature range (80...95 Celsius degrees), a maximum extraction degree can be attained (fig. 1) and at the same time the obtained oil is of the highest quality, for which reason the ground oleaginous seeds are transferred from the hydrothermal processing system directly to the pressing equipment without any intermediate processing [12].

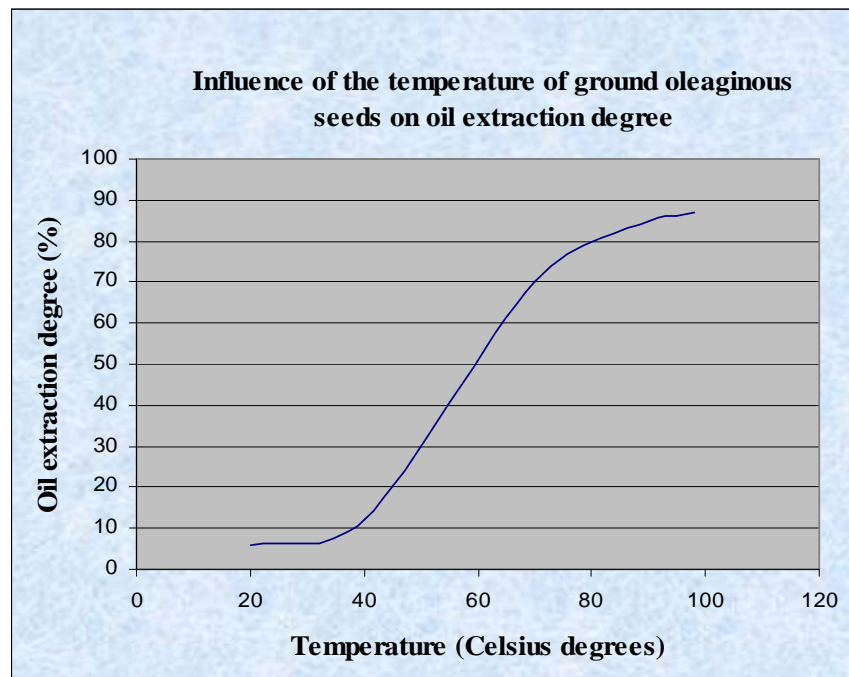


Fig. 1. Influence of the temperature of ground oleaginous seeds on oil extraction degree.

Following the introduction of the oleaginous material into the pressing chamber (fig. 2), the first thing that occurs is the separation of oil (over a short period of time) without any exterior action, only through the effect of the gravitational field and of the pressure of material layers. This first phase unfolds as a shear filtering process under the influence of a hydrostatic pressure. The actual pressing process is achieved through the action of an active organ (piston in our case), which initially achieves a compression of the oleaginous materials aimed at eliminating air pockets by evacuating the air existing between

the particles of ground seeds. This is followed by the separation of the oil kept on the surface of the particles due to the surface forces of the molecular field, through the channels formed between the particles [5]. The increase in the pressing forces engenders a decrease in particle volume, which causes the oil to be eliminated from the particle capillaries, at the same time as the separation of the oil existing on the surface thereof. The increase in the pressure exerted on the ground oleaginous seeds needs to be gradual, so that the finely ground particles do not obstruct the capillaries thereby blocking oil evacuation.

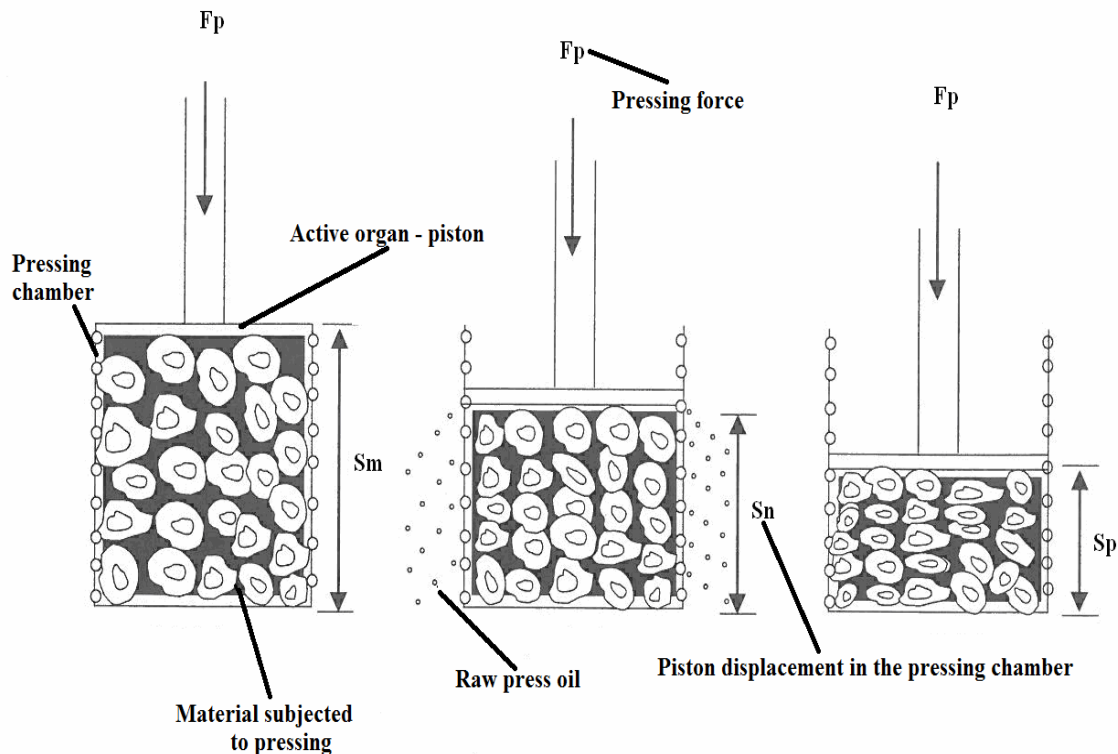


Fig. 2. Schematic representation of the pressing process.

When the space between the surfaces of two particles becomes so narrow that the oil film is subjected to the retention forces exerted by both particle surfaces, the oil cannot be eliminated anymore, the film breaks in several places, the surfaces hit one against the other and the so-called oilseed cakes are formed.

Considering the structure of the ground and thermally processed oleaginous material and the manner in which oil extraction is achieved, the pressing may be defined as the physical process of partial separation, under the action exerted by outer forces, of the liquid phase (oil) from an

heterogeneous solid-liquid mixture (ground oleaginous seeds). The essential requirement to be met by the materials to be put through the pressing process is that the skeleton of the solid substance of the phases system be compressible and that draining capillaries be formed, enabling the passing of the liquid phase.

### 3. Conclusions

- Sunflower oil is an excellent edible oil which has come to be more and more appreciated in modern dietetics due to its high unsaturated fatty

acids content (85...91%) mostly represented by the oleic and linoleic acid (up to 65%), one of the essential nutritive fatty acids. Unlike the other vegetable oils, sunflower oil ideally combines the high nutritive value with stability and a long shelf-life, owing to the absence of the linolenic acid. From this perspective, no other vegetable oil can stand comparison;

- Given the numerous advantages resulting from the hydrothermal processing of the ground oleaginous seeds (increase in oil fluidity, which engenders a better circulation, thereby requiring

less effort on pressing, an increase in the porosity of the oleaginous material, a reduction in the humidity of the ground seeds and oil, the elimination of various fragrant substances), at an industrial level, such operation tends to become mandatory in the case of oil extraction from sunflower seeds;

- Vegetable oil extraction by pressing hulled and thermally processed sunflower seeds is the most adequate modality of increasing the extraction degree and the quality of obtained oil and oilseed cakes.

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## MINITUBERS PLANTING EFFICIENCY IN THE OPEN FIELD AND PROTECTED AREAS

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**Abstract:** Due to extremely high biological value of the material from the upper links of potato, economic interpretation starts from the necessity premise use of minitubers and full recovery as planting material of tubers production resulted by planting them. We studied the values of net benefit in function of protected areas with tunnels "insect proof" and field, size fraction (15-25mm and 25-35mm) and planting density (8;6; 5 minitubers/linear meter) for three cultivars: Christian, Roclas, Desiree. By the marginal analysis were selected as the most profitable experimental variant V10, for Christian variety, with the marginal net benefit of 161,30 thousand lei/ha, consisting in protected area x size fraction: 25-35 mm x density: 8 minitubers / linear meter.

**Keywords:** minitubers, profit, marginal analysis, net benefit, expenditure

### Introduction

Mini-tubers are small seed potato tubers produced after acclimatization from plants propagated *in vitro* and planted at high density in the glasshouse in seed beds or in containers using different substrate mixtures. Mini-tubers can be produced throughout the year and are principally used for the production of pre-basic or basic seed by direct field planting (Lommen, 1999; Ritter *et al.*, 2001). The size of mini-tubers may range from 5-25 mm although in current systems larger mini-tubers also have become common. This size range coincides with a weight range of 0.1-10 g or more (Struik, 2007). The quality of the transplant is very important for the production of mini-tubers (the original *in vitro* plantlet) (Struik, 2007; Jami Moein *et al.*, 2001).

In Romania, the current technology for seed potato production, provides minitubers production from *in vitro* plantlets, transplanted in protected areas ("insect-proof" areas) to produce pre-basic material (Chiru and collaborators, 1997) on a substrate composed of soil and peat, which will be used to obtain clonal material for the following links (to the field clonal of Lăzarea, Harghita County).

### Materials and methods

Using ECON function of the package MSTAT-C program is made possible economic representation of experimental variants and

enables selection of technological sequences studied in economic criteria (Ianosî and collaborators, 1995).

Calculations were made based on 2009-2010 average prices and production levels achieved through experimentation, on the fraction size, for the varieties Christian, Roclas and Desiree.

Economic calculations are based on production from Christian varieties, Roclas and Desiree, who were registered in 2008-2009 in the experimental variants consist of combinations of technology culture (open field and tunnel "insect proof"), two size fractions minitubers of 15-25 mm and 25-35 mm and three planting densities per line, 8, 6 and 5 plants per linear meter.

The method of interpretation is based on calculating, for each variant, the average profit by subtracting the output value realized per hectare variable costs due to variants studied (Ianosî *et al.*, 1995), in this case the cost of minitubers used for a hectare a densities studied.

For the calculations, have used different prices for the fraction of planting, respectively 0.15 lei/piece (for fraction 15-25mm) and 0.20 lei / piece (for fraction 25-35 mm).

Studied factors (table 1):

-Factor A: The experiment with two graduations:

-a1 - experiments in field

-a2 - experiments in tunnels

-Factor B: Minitubers size used in planting, with two graduations:

-b1: <25 mm

-b2: 25 - 35 mm.

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-Factor C: planting density, with three graduations:

-c1- 114. 285 minitubers / ha (70 x 12.5) = 11.4 pl/m<sup>2</sup> (8 minituber/ linear meter)

-c2- 86 .058 minitubers / ha (70 x 16.6) = 8.6 pl/m<sup>2</sup> (6 minituber/ linear meter)

-c3 - 71. 428 minitubers / ha (70 x 20.0) = 7.1 pl/m<sup>2</sup> (5 minituber/ linear meter)

Table 1

*Variants and combinations of factors*

Variants	Combination of factors
V1	a <sub>1</sub> b <sub>1</sub> c <sub>1</sub>
V 2	a <sub>1</sub> b <sub>1</sub> c <sub>2</sub>
V 3	a <sub>1</sub> b <sub>1</sub> c <sub>3</sub>
V 4	a <sub>1</sub> b <sub>2</sub> c <sub>1</sub>
V 5	a <sub>1</sub> b <sub>2</sub> c <sub>2</sub>
V 6	a <sub>1</sub> b <sub>2</sub> c <sub>3</sub>
V 7	a <sub>2</sub> b <sub>1</sub> c <sub>1</sub>
V 8	a <sub>2</sub> b <sub>1</sub> c <sub>2</sub>
V 9	a <sub>2</sub> b <sub>1</sub> c <sub>3</sub>
V 10	a <sub>2</sub> b <sub>2</sub> c <sub>1</sub>
V 11	a <sub>2</sub> b <sub>2</sub> c <sub>2</sub>
V 12	a <sub>2</sub> b <sub>2</sub> c <sub>3</sub>

### Results and discussion

For **Christian** variety, the marginal analysis selected as the most profitable experimental variants V9, V8, V12, V11 and V10.

For these variants are obtained benefits (BN) which recovers variable costs due to experimental variations (figure 1).

The greatest benefit was achieved at V10- a<sub>2</sub> b<sub>2</sub> c<sub>1</sub>, the interaction between the protected space x size fraction: 25-35 mm x density: 8 minitubers / linear meter (161.50 thousand lei/ ha).

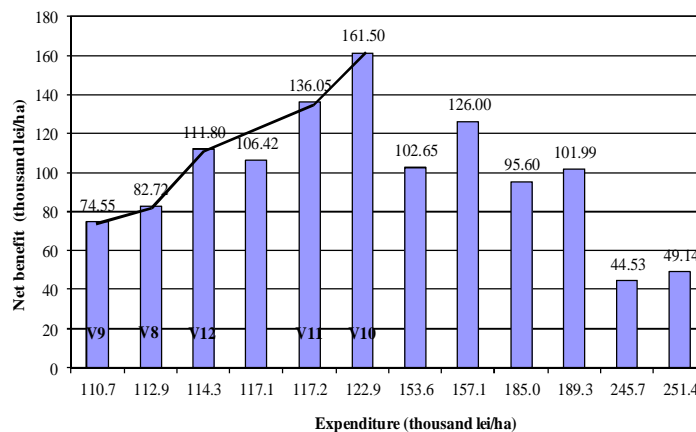


Fig.1. Profitable variants selected by the marginal analyzing for Christian variety (Lăzarea, District Harghita)

For **Roclas** variety, the marginal analysis selected as the most profitable experimental variants V9, V8, V12, V7, V11 and V6 (figure 2).

The greatest benefit was achieved at V6 - a<sub>1</sub> b<sub>2</sub> c<sub>3</sub>, the interaction between the field x size fraction: 25-35 mm x density: 5 minitubers / linear meter (151.50 thousand lei/ ha).

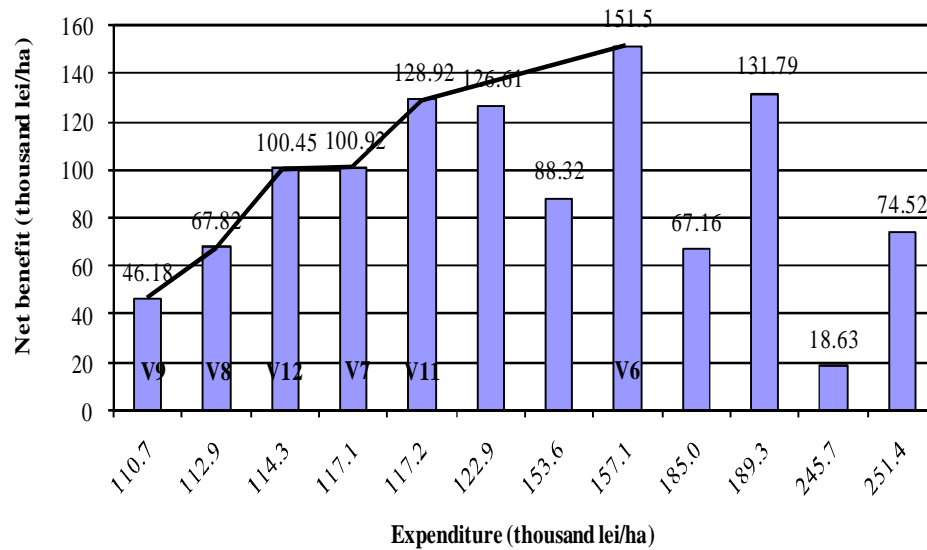


Fig.2. Profitable variants selected by the marginal analyzing for Roclas variety (Lăzarea, District Harghita)

For **Desiree** variety, the marginal analysis selected as the most profitable experimental variants V9, V8, V12, V7, V11 and V10, increasing of expenditure, attracting growth of the net profit (NB) greater than 10%. For these variants are obtained benefits (BN) which

recovers variable costs due to experimental variations (figure 3).

The greatest benefit was achieved at V10- a<sub>2</sub> b<sub>2</sub> c<sub>1</sub>, the interaction between the protected space x size fraction: 25-35 mm x density: 8 minitubers / linear meter (144,32 thousand lei/ ha).

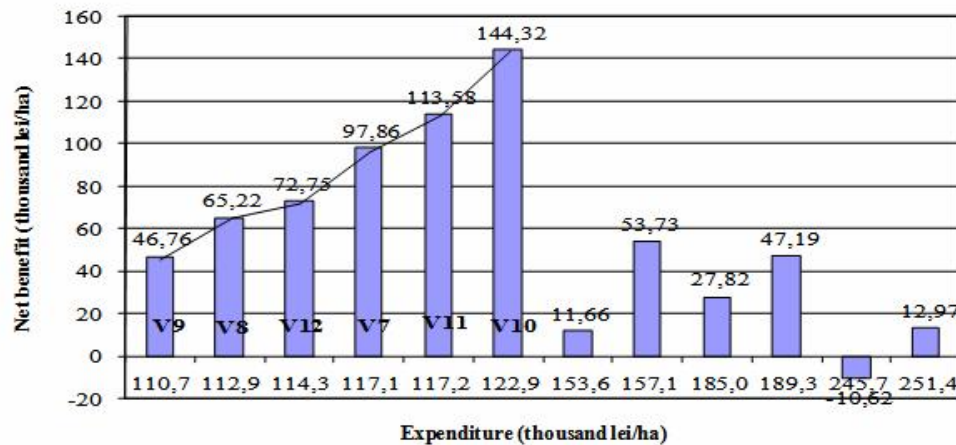


Fig.3. Profitable variants selected by the marginal analyzing for Desiree variety (Lăzarea, District Harghita)



**Conclusions:**

By the marginal analysis were selected as the most profitable experimental variants V11, V12, V8, V9; the marginal net benefits varied between 136,05 thousand lei/ha for variant V11, consisting in protected area x size fraction: 25-35 mm x density: 6 minitubers / linear meter and 46.18 thousand lei/ha for variant consisting in protected area x size fraction: 15-25 mm x density: 5 minitubers / linear meter.

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## RESEARCH REGARDING THE INFLUENCE OF HARVESTING WORK OVER POTATOES TUBERS INJURY

Capatana I.\*      Bratucu Ghe.\*\*

**Abstract:** *In the paper are presented the results of experimental researches regarding the mechanical injuries of the potato tubers during the harvesting process. The researches were made in autumn of the year 2010, in four locations, where they were cultivated different types of potatoes. At harvesting were used five different types of equipments. The samples consist in one thousand tubers, which were calibrated according to the existing norms, and then they were sorted in order to identify the mechanical injuries. It has been found that the largest percentage of injured tubers has been manifested at the IMPALA potatoes type, cultivated for seed, the sort between 50...55 mm, grown in Tinoasa village from Covasna county and harvested with the potatoes harvesting machine with one row Grimme SE 75-30, made in Germany. In all the cases were determined the soil humidity and resistance to penetration.*

**Keywords:** *Potato, mechanical injury, harvesting.*

### 1. Introduction

The potato is a staple food, both in Romania and at global scale. His content of nutrients and vitamins recommend him for use in various food recipes, available for consumers of all ages. Higher productions on hectare and climatic conditions of specific areas in Romania have made the potato a principal product for the existence of a large number of farmers. At the same time the potato proved to be a vegetable product particularly sensitive to fluctuations of temperature and humidity, soil physical and chemical characteristics and especially to a lot of diseases and pests.

The technologies and equipment used in potato production and primary processing follow the idea of ensuring a quality product under ecological aspect and with total low costs. It turns out however, that most of the existing potatoes on the market contain harmful elements, are sick and degraded from the use of inappropriate technologies and equipment for there production, conditioning or for there processing.

### 2. Material and method

In this paper are presented the results of experimental researches conducted to determine the influence of the potato harvest work on its quality

depending on the type of harvesting equipment, the soil condition (moisture content, penetration resistance) and the potato type.

To determine the soil characteristics it was used the static penetrometer Dickey-John (Figure 1), at which the pressure is created by the human operator, and the soil penetration resistance is converted to analog signals and read from the meter device in lbf / inch<sup>2</sup> (1 lbf/inch<sup>2</sup> = 1 / 6, 895 kPa). Soil moisture was measured by capacitive portable humidity analyzer KKT (Figure 2) of PT-1 type, intended for rapid determination of soil moisture content directly in the field.

The measurements consisted from determining the soil characteristics (moisture, soil penetration resistance) in both the potato billon zone (at a depth of 20 cm) and between billons (at surface - 10 cm and deepness - 50 cm) and in the determination of the injury degree of the tubers after harvest with different types of equipment.

From the analysis of the potatoes characteristics obtained and processed by different technologies and existing equipment can be detached proposals for selecting the best of them, at which it can be analyzed the points where improvements may be proposed, leading to elimination of the causes of physical degradation of the potato.



Figure 1. *Static penetrometer DICKEY-John*



Fig. 2. *Capacitive portable humidity analyzer KKT*

To determine the tubers injury degree, from the bunker of each harvesting equipment have been studied 1000 potatoes, which were first split in size classes accordingly with STAS (25, 28, 35, 40, 45, 50, 55, 60, 65, 70, > 70 mm) using a manual

calibration device (Figure 3). For each size class the tubers were checked and divided into three categories: good, lightly injured and injured in depth.



Figure 3. *Manual potato calibration device*

### 3. Results and discussions

The experimental researches were made in for different locations with five types of potatoes harvesting machines have is follows:

- In the village Prejmer, the harvesting was performed with a propelled potatoes harvesting machine type THYREGOD made in Denmark in 1975. This type of potatoes harvesting machine works on a single road in aggregate with the tractor U 703 DT. The harvested potatoes were from the Roclas variety.

- At the National Research Institute for Potato and Sugar Beet Brasov the harvesting was done with a propelled potatoes harvesting machine Grimme 150-60 manufactured in Germany. This type of harvesting machine works on two roads in aggregate with the tractor NEW HOLLAND TD 5050. Harvested potatoes were from the Christian variety.
- In the village Sântionluca - Covasna, the potatoes harvesting was done with a self-propelled machine GRIMME SF 150-60 manufactured in 2005, which works on two. The harvested potatoes were from IMPALA variety (for consumption).

- In the village Tinoasa - Covasna, the harvesting was done with a potato harvester Grimme SE 75-30 manufactured in 2008, which works on none road. The machine works in aggregate with the BELARUS 952 tractor. The variety of potato: IMPALA (grown for seeds).
- In the National Research Institute for Potato and Sugar Beet Brasov was harvested an experimental

lot with a potato harvester MRC-2 on two roads in aggregate with L-445 tractor. The variety of potato: DESIREE.

The measurements results of the soil conditions at harvesting and tubers injury degree after the harvesting process were summarized in tables for each location and type of equipment in part as in the following example:

Table 1

#### Soil status in the moment of potatoes harvesting:

Probe place	Depth, [cm]	Humidity, %	Penetration resistance, [MPa]
Billon	20	29,1	1,24
		29,9	0,99
		29,1	0,93
		27,4	1,10
		28,3	0,96
Between billions	10	29,2	2,06
		30,2	1,72
		28,5	1,72
		27,9	1,58
		30,0	1,79
	50	34,9	1,72
		34,0	1,37
		32,3	1,51
		34,3	1,44
		32,3	1,58

Table 2

#### Tubers status after harvesting:

Nr. crt.	Dimension class, mm		Tubers status			Total number of potatoes on dimension classes, pieces	Share, %
			good,	Superficial injured	injured in depth		
1.	Under STAS	25	0	0	0	0	<b>0</b>
2.		28	0	0	0	0	<b>0</b>
3.	For seeds	35	6	3	0	9	<b>0,9</b>
4.		40	19	7	0	26	<b>2,6</b>
5.		45	51	18	2	71	<b>7,1</b>
6.		50	105	48	3	156	<b>15,6</b>
7.	For consumption	55	157	61	4	222	<b>22,2</b>
8.		60	128	33	3	164	<b>16,4</b>
9.		65	127	55	5	187	<b>18,7</b>
10.		70	75	41	2	117	<b>11,7</b>
11.		> 70	26	22	0	48	<b>4,8</b>
Total number of potatoes, pieces			<b>694</b>	<b>288</b>	<b>19</b>	<b>1000</b>	
Share, %			<b>69,4</b>	<b>28,8</b>	<b>1,9</b>		

After analyzing the results, were prepared two tables to represent the tubers status depending on the potato variety (table 3) and the injured tubers status

depending on the potatoes variety and class dimensions (table 4).

Table 3

*Tubers status depending on the potato variety*

Nr. crt.	Potato variety	Tubers status, %		
		good,	Superficial injured	injured in depth
1.	ROCLAS	96,6	2,9	5
2.	CHRISTIAN	83,4	13	3,6
3.	IMPALA (for consumption)	91	7,5	1,5
4.	IMPALA (for seed)	69,4	28,8	1,9
5.	DESIREE	96,2	1,3	2,5

Table 4

*Injured tubers status depending on the potatoes variety and class dimensions*

Nr. crt	Dimension class, mm	Injured tubers status, %				
		ROCLAS	CHRISTIAN	IMPALA (for consumption)	IMPALA (for seed)	DESIREE
1.	25	0	0	0	0	0
2.	28	0,3	0	0	0	0,1
3.	35	0,5	0	0,1	0,3	0,3
4.	40	0,6	1,0	0,2	0,7	0,6
5.	45	0,6	1,8	0,7	2,0	1,3
6.	50	1,2	4,7	0,9	5,1	0,8
7.	55	0,1	5,1	3,2	6,5	0,3
8.	60	0,1	2,2	1,5	3,6	0,3
9.	65	0	1,3	1,6	6,0	0,1
10.	70	0	0,4	0,6	4,3	0
11.	> 70	0	0,1	0,2	2,2	0

#### 4. Conclusions

The most efficient potato harvesting equipment in terms of avoiding damage to tubers is self-propelled harvesting machine, this equipment is more compact and more automated than propelled harvesting machines, allowing immediate adjustment and effective supervision of the harvesting process throughout its route, through cameras and various sensors fitted to this type of equipment.

- In the case of studied propelled harvesting machines it has been registered a greater tubers injury degree because the ends of potatoes rows were harvested by harvesting potatoes machines MSC-1 or MRC-2. The harvesting of the ends rows with the least efficient equipment is usually required

to achieve an optimal space for turning and maneuvering the harvesting machine at the ends of row.

- Tubers depth injuring is largely due to inadequate adjustment of the potatoes harvesting machine cutters.
- Superficial injuring of the tubers varies from one potato variety to another and even for the same variety of potato, for example, the IMPALA variety grown for seed has a higher degree of injury than same variety for consumption, because the seed potato has a shorter growing season and its skin is more sensitive.
- The potatoes harvesting is good to be made at the optimum humidity for each soil type, for example in soils of Tinoasa area the optimum humidity is about 28.5 ... 29.5% in billons. For soil in Prejmer area the moisture of 25% was found to be

too high and the optimum moisture at INCDCSZ area is 20 ... 22%, while the 24 ... 25% humidity proved inadequate.

- The soil penetration resistance presents on big interest in energy consumption at the potatoes harvesting work and less interest for the injury degree of tubers.

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# INFLUENCE OF PVY INOCULATION AND DROUGHT CONDITIONS ON PEROXIDASE ACTIVITY IN POTATO PLANTS (*Solanum tuberosum L.*)

C.L. BĂ D Ă RĂ D. FLORENTINA A. MĂRCULESCU

**Abstract:** The goal of this research was to evaluate the combined effects of virus inoculation and of the stress caused by drought conditions on peroxidase activity and tuber yield from PVY mechanically inoculated plants (varieties Romano, Christian, Rustic, Dacia, Magic, Dumbrava, Astral, Tâmpa, Roclas, Cumidava). The cause of the poorer properties of potato tubers might not only be the water shortage itself but could also be the enhanced production of reactive oxygen species (ROS) accompanying practically every kind of stress, both biotic and abiotic. However, antioxidative enzymes seem to counteract ROS accumulation and, thus might protect plants against the damages effects of environmental stresses. The tubers from cultivar Christian had the higher value of peroxidase activity (significantly comparatively with the other variants). Increased activity of peroxidase protects plants from oxidative stress and consequently, against yield losses.

**Keywords:** potato virus Y, peroxidase activity, drought.

## 1. Introduction

Between the potato pathogens (*Solanum tuberosum L.*), the viruses might induce strong stress in plants. This stress alerts plants development and grow because of the changes in metabolism. In several situations, these changes may lead to plant death. One of the consequences of stress is an increase in the cellular concentration of reactive oxygen species (ROS). ROS cause damage of DNA, oxidise amino acids and proteins, and favour lipid oxidation. Sometimes, the pathogen attack or another factors may disturb the redox homeostasis and even may lead to oxidative stress under severe conditions (function on the pathogen, on the environmental conditions) (Serrato et al., 2004; Miao et al., 2006; Giraud et al., 2008). Plant cells have defensive responses to pathogen attack associated with changes in oxidative metabolism (López-Delgado et al., 1998). For stopping the accumulation of oxygen radicals, in the aim to avoid damage of biological structures, plants have involved an antioxidant defence system consisting in antioxidants molecules (ascorbic acid, glutathione and tocopherol) and antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT) and peroxidases (POXs). The radical superoxide generated in plant cells are converted into H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub> by the action of

SOD. The H<sub>2</sub>O<sub>2</sub> produced is eliminated by CAT without use another substrate (Pereira 2002) and by several classes of peroxidases such as guaiacol peroxidase (GPOX) and ascorbic acid peroxidase (APX) (Kopyra nad Gwozdz 2003). In many plants, about 90% of the peroxidase activity is referred to as guaiacol (anionic) peroxidase (Foyer, 1994).

We chose for our experiments the potato virus Y (PVY) (*Potyvirus*) because it is one of the most important viruses of potato (*Solanum tuberosum L.*) (Ragsdale et al., 2001).

High PVY level can cause stand loss, reduced yields, undersized tubers and reduced quality (Hane, D., C, Hamm, P.,B, 1999). Over the past 20 years, PVY has become an increasingly serious constraint to seed potato production in the world (Beemster, 1987 ; Hane, D., C, Hamm, P.,B, 1999). Thus, efforts to control PVY are essential when producing potatoes for market or seed (Bă d ă r ă d., L. et al., 2009a; Bă d ă r ă d., L., et al., 2010a; Bă d ă r ă d., L. et al. 2010b)

Therefore, the aim of the present study was to clarify the relation between the involvement of antioxidant enzymes that could limit ROS production in potato inoculated plants in response to a short term soil drought.

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## 2. Materials and methods

**Plant material.** The researches were carried out with ten potato (*Solanum tuberosum* L.) varieties differing in dehydration tolerance and susceptibility to PVY: Romano, Christian, Rustic, Dacia, Magic, Dumbrava, Astral, Tâmpa, Roclas, Cumidava. Plants were grown in a vegetation house under natural conditions of light and temperature in pots filled with a peat sand substrate, pH 5.5. Plants were watered daily to provide an optimal water supply. Three weeks after tuberisation, part of plants were subjected to soil drought conditions by withholding water for 2 weeks and the remaining part of the plants were still receiving water (control plants). After this drought treatment, the plants were rewatered and grown under the same conditions as the control plants until maturity. For obtaining positive material, a part of these plants have been mechanically inoculated, using a PVY secondary infected plant from Record variety. The infection of the material was confirmed by ELISA tests.

**ELISA test.** A press with smooth roles was used for preparation leaf samples. The antiserum and conjugated used for viruses detection were obtained in our laboratory (Cojocaru, N. et al., 2009)

The analysis was performed following essentially the protocol described by Clark and Adams (1977) (Clark, M.,F., Adam, A.,N, 1977) (100 µl from each reactives solutions). Microplates were filled with substrate solution (p-nitrophenylphosphate) incubated 1 hour and the absorbance values were estimated at 405 nm ( $A_{405}$ ) on PR1100 reader. The samples having  $A_{405}$  values exceeding the cut-off (two times the average of healthy controls) were considered virus infected.

**Yield decrease** Yield decrease was calculated according to the formula  $100 \times [( \text{weight of potato tubers from plants PVY inoculated and treated with essential oils and optimal water supply} - \text{weight of potato tubers from plants PVY inoculated and untreated with essential oils and subjected to soil drought}) / \text{weight of potato tubers from plants PVY inoculated and treated with essential oils and optimal water supply}]$ . (Boguszewska D. et al., 2010)

**Reducing sugar and sucrose content** Reducing sugar was determined spectrophotometrically using the dinitrophenil reagent (Talbur and Smith 1959) and sucrose content using the anthrone reagent (Sowokinos, 1978).

**Protein extraction and enzymes assay** Leaves and middle slices of potato tubers were taken from the same plant. Samples were weighed and stored at -20°C until to use. Plant material was ground in mortar. Total protein was extracted in 50mM HEPES pH 7.4 containing 2mM EDTA, 2mM cysteine and 5% (w/v) insoluble polyvinylpyrrolidone. The homogenisates were centrifuged at 10000xg for 15 min at 4°C and supernatants were directly used.

**Peroxidase (GPOX, E.C. 1.11.1.7) activity** was assayed using guaiacol as a substrate. The reaction mixture (2 ml) consisted of 0.02M guaiacol, 0.05 M phosphate buffer (pH 5.60, and 0.1 ml of enzyme extract. The reaction was started by adding 0.6 M  $H_2O_2$ . (Patykowski et al, 1988). The oxidation of guaiacol was estimated by measuring the increase in absorbance at 485 nm for 1 min. GPOX activity was expressed in milimoles per minute per milligram of protein.

Total protein content in extracts was determined spectrophotometrically at 595 nm according to the method of Bradford (1976) using bovine serum albumin as a standard.

**Native Polyacrilamide Gel Electrophoretic** separation was performed using 4% stacking gel and 10% polyacrilamide resolving gel as described by Laemli (1970). Samples (30mg) were diluted in loading buffer in relation 1:1 (50mM Tris HCl pH 6.8; 0.1% bromophenol blue, and 10% glycine). Gel electrophoresis was run at 40°C for 3 hours with constant current of 30mA. Peroxidase (GPOX, E.C. 1.11.1.7) was visualized by incubated the gel in 50 mM potassium phosphate buffer, pH 5.0 containing 2 mM benzidine and 3 mM  $H_2O_2$  until appearance of orange bands.

## 3. Results and Discussion

A reliable and widely-used indicator for defining the sensitivity of plants to stress is considered the leaf relative water content (Rampino et al., Sanchez-Rodriguez et al. 2010). In our study, water content (RWC) in leaves of investigated potato cultivars which were stressed by virus inoculation and by withholding water for 10 days diminished considerably to the level of about 45-65% RWC (fig. 1). Literature indicators that drought is a major abiotic factor limiting crop productivity, and that yield decrease can be taken as a main criterion of plant resistance to drought. However in our study, the correlation between relative water content and yield decrease was poor. The observed difference in RWC in



leaves of investigated potato cultivars indicated that neither the time course of dehydration nor the attained leaf RWC values related to tuber yield. The observed differences in leaf RWC

attained at the same drought period indicated that investigated cultivars differed in characteristics responsible for dehydration avoidance.

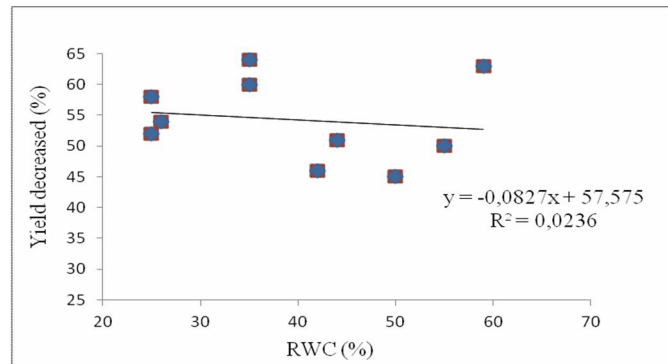


Fig. 1. Relation between yield decrease (%) and relative water content in leaves (RWC%) of potato varieties tested

The research showed differences between individual varieties in their ability to avoid dehydration: the cultivars representing the most dehydration resistant ones were the cultivars Christian and Roclas, while the most susceptible variety was Tâmpa.

Regeneration of plants refers to their ability to recover from soil drought after plant rehydration

by replacing lost organs or restoring damaged ones. The correlation between the ability to regenerate after stress relief and the yield decrease was strong (fig. 2) Such a correlation makes it possible to predict the yield of potato tubers; the ability to regenerate seems to be a better indicator of plant susceptibility to drought than RWC value alone.

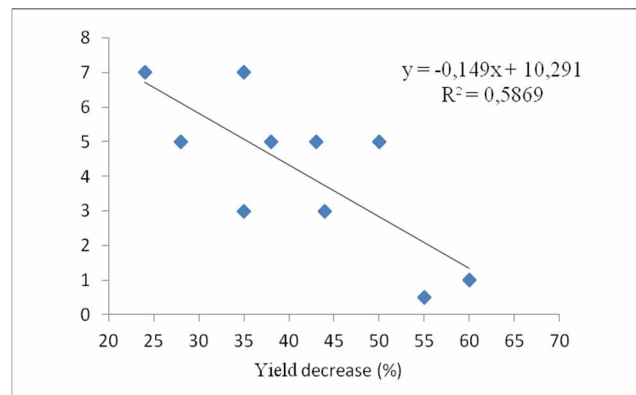


Fig. 2. Relation between plant regeneration ability and yield decrease (%) of potato varieties

Reducing sugar concentration was different for the different potato genotypes. Soil drought did not affect the level of reducing sugar in tubers of Dacia cultivar, but enhanced the reducing sugar level in cultivars Romano, Christian, Magic, Dumbrava, Astral, and reduced it in the varieties Rustic, Tâmpa and Cumidava (table 1). In contrast, sucrose concentration decreased in tubers of all investigated cultivars. Soluble sugars play a major role in the structure and function of plants. Glucose and fructose (monosaccharides) are sources of energy and carbon whereas sucrose

plays a central role in photosynthesis and transport in photosynthetic organs and is used by heterotrophic organs of the plants (Couee et al. 2006). Glucose, fructose and sucrose have often been considered to undergo parallel changes (Brouquisse et al. 1991, Graham et al. 1992). However, in our experiments, the ratio of reducing sugars to sucrose content increased in more resistant cultivars and decreased in susceptible cultivars in response to drought. For example, for cultivar Tâmpa, this ratio decreased from 3.43 to 1.25. Soluble sugars seem

to play a dual role with respect to ROS because they are involved in the metabolism and protection of both ROS-producing and ROS scavenging pathways (Miller et al. 2010). Soluble sugar can feed the oxidative pentose phosphate pathway, a pathway producing NADPH which can scavenge ROS via the ascorbate-glutathione cycle, or

accumulation of sugars may lead to ROS production (Foyer and Norton, 2009). Since most of the plant peroxidase (POX) activity (about 90%) can be ascribed to guaiacol POXs, for example haem-containing proteins (Foyer and Norton, 2009), conventional methods for measuring POX activity were used.

Table 1

*Reducing sugars and sucrose concentration (% of FM) in potato tubers in control, fully turgid plants (C) and in plants subjected to dehydration (D) and mechanical PVY inoculation (I)*

Variety	Reducing sugars		Sucrose	
	C	D+I	C	D+I
Romano	0.05	0.10	0.11	0.13
Christian	0.04	0.01	0.27	0.36
Rustic	0.07	0.03	0.14	0.18
Dacia	0.05	0.04	0.16	0.30
Magic	0.05	0.08	0.15	0.18
Dumbrava	0.01	0.05	0.12	0.13
Astral	0.02	0.1	0.08	0.15
Tâmpa	0.25	0.15	0.07	0.12
Roclas	0.15	0.24	0.15	0.18
Cumidava	0.23	0.12	0.22	0.25

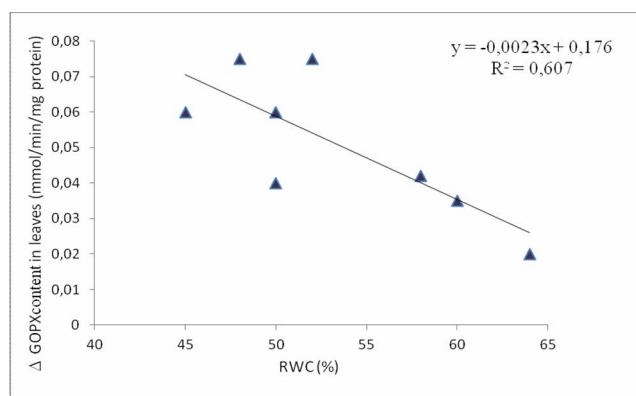


Fig. 3. Relation between the relative increase in guaiacol peroxidase activity ( $\Delta$ GPOX in millimoles /minutes / mg protein ) in potato leaves and relative water content (RWC %) of potato varieties tested

A high correlation was observed between the relative increase in guaiacol peroxidase activity (i.e. POX activity in droughted leaves minus POX activity in turgid leaves) and relative water content in potato leaves concerning the variants

inoculated (fig. 3). Similarly, a substantial increase in guaiacol POX activity was observed in maize seedling acclimated to suboptimal growth temperature (Prasad, 1996).

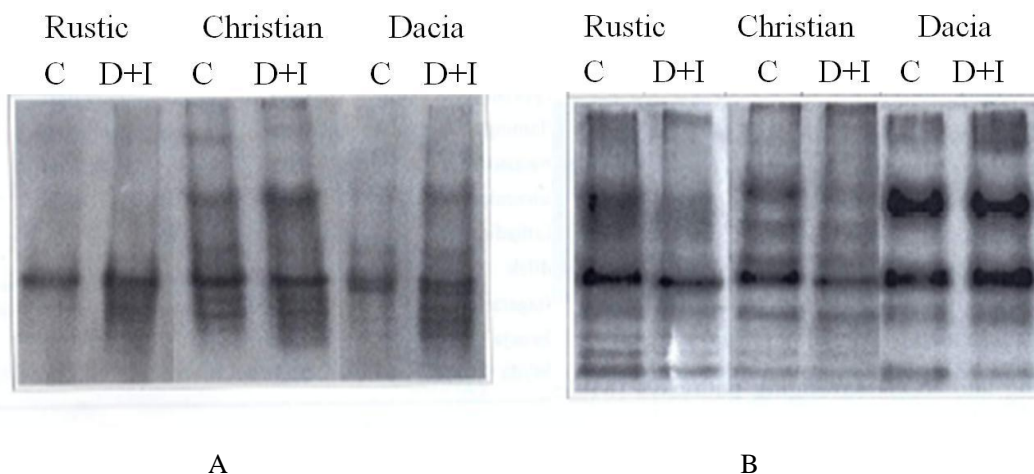


Fig. 4. A. Peroxidase activity in control, fully turgid leaves (C) and in leaves subjected to dehydration and PVY inoculation (D+I) plants for three varieties  
 B. Peroxidase activity in control, fully turgid tubers (C) and in leaves subjected to dehydration and PVY inoculation (D+I) plants for three varieties

These phenomena might indicate that a high activity of guaiacol POX is a common response of plants to unfavourable environmental conditions. The band activity of guaiacol peroxidase confirmed the spectrophotometric measurement of POX activity: in leaves of droughted plants, the bands with the highest activity and an increase in number of activity bands were observed in cultivar Christian (with a yield decrease of 49%) whereas in leaf extracts from cultivar Rustic (with a yield decrease of 26% only two new activity bands appeared) (fig. 4A). In contrast, the response of POX in potato tubers was cultivar dependent (fig 4B) The response of potato tubers to drought was either negative, i.e. activity of peroxidase bands decreased (cultivars Rustic and Christian, for example) or remained at the level of control, turgid plants (cultivar Rustic).

#### 4. Conclusions

The present study showed that the yield of potato plants, even inoculated with PVY, depended more on the regeneration ability of plants after drought relief than on the water loss from the leaves. Relative water content reflected guaiacol peroxidase activity in droughted potato leaves from PVY inoculated plants. Increased activity of POX in leaves and tubers of dehydrated cultivar Christian seemed to counteract the accumulation of ROS and in effect protected the plants against the loss of tuber yield.

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- Abbreviations:** PVY potato virus Y; APX ascorbate peroxidase; CAT catalase; DW Dry Weight; GPOX guaiacol peroxidase; FM fresh matter;FW fresh wieight; PAGE polyacrylamide gel electrophoresis; POX peroxidase; ROS reactive oxygen species; RWC relative water content; SOD superoxide dismutase; SW saturated weight

## TECHNOLOGY OF DRYING THE MEDICINAL PLANTS DESIGNED TO IMPROVING THE USEFUL VEGETAL MATTER QUALITY

ADRIANA MUSCALU\* MARIN MIHAI VALENTIN VLĂDUȚ ALINA DUNE

**Abstract:** Drying the herb of medicinal and aromatic plant is a technological stage which is compulsory within the capitalization of this category of products.

In the paper, there are presented a technology based on a technical system of kiln type, designed to processing medicinal and aromatic plant crops or those belonging to spontaneous flora, as well as the experiments results. The novelty brought by this method is the kiln heating system comprising infra-ceramic radiators, which uniformly distribute the heat and have a large radiating surface. As regarding the farmers, especially those owning family farms the development of entrepreneurial initiatives of producing and primarily processing the medicinal and aromatic plants should be supported by state-of-the art and efficient installations.

**Keywords:** medicinal and aromatic plants, activ principlese, processing, infra-ceramic radiators.

### INTRODUCTION

The desiccation of vegetal matters has been practised for the most ancient times. Therefore the quantities performed within the time unit as well as the vegetal matter resulted quality have evolved especially towards the artificial drying systems, by rapidly inhibating the enzymes degrading process.

The desiccation process of medicinal and aromatic herbs is differently carried out depending on the type of working parts processed, their shape and consistency, water quantity they contain and the conditions imposed for preserving the active principles. The drying technology we present is based on a technical

multifunctional system, of oven type, achieved as an experimental model at INMA Bucarest. The utilization field comprises cultivated species of medicinal and aromatic plants or belonging to spontaneous flora.

### MATERIALS AND METHOD

The oven experimental model and its main component sub-assemblies, manufactured according to relevant documents are shown in figure 1.

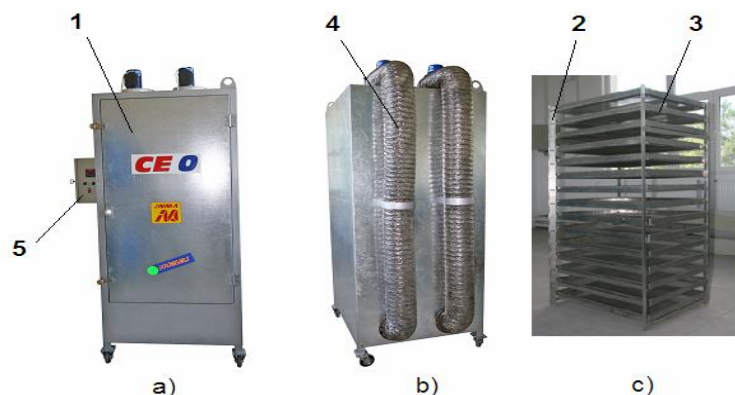


Fig. 1 – Drying oven CE-0

a) front view; b) rear view; c) inner drawers support with drawer for medicinal and aromatic herbs,

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The main subassemblies making up the technical equipment which can be used silk cocoons stifling are:

- 1 - Drying precincts;
- 2 - Drawers support;
- 3 - Drawer for medicinal and aromatic herbs;
- 4 - Air recirculating installation
- 5 -- Electric and automation installation;

#### **Functional description**

Drying process is taken place by transfer of heat and substance, removing a part of containing liquid ( usually water), using a humidity enhancing agent, which concomitantly provides the thermal energy necessary to the process. [1]

Inside the drying oven the thermal process is performed through the agency of a combination between the thermal convection and the radiation,, between the fluid and the solid, being transmitted a complex thermal flow, in the conditions when the hot air recirculation and its refreshing are possible. The infra-ceramic radiators forming the oven heating system are characterized by a uniform heat distribution and large radiating surface. At their surface, the radiators can reach during the operation a regime temperature of 400<sup>0</sup>C, the range of radiations wave lengths being of 2-10  $\mu$ m.

As any other process the oven drying is influenced by several factors types, such as: factors related to matter to be dried (quantity,

shape, initial humidity, bulk density etc.), factors related to desiccating agent, (temperature, relative humidity, hot air flow rate) as well as factors related to dried material obtained (final humidity, temperature, chemical, biochemical, sensorial degradation etc.). [1]

For medicinal and aromatic plants, the temperature limitation is first imposed by the necessity of preserving the container active principles.[3] The long- time practice has established that for drying the plants containing essential oils the maximum temperature should not exceed 35-40<sup>0</sup>C and for those containing alkaloids and glycoids it ranges between 50 and 60<sup>0</sup>C. The medicinal and aromatic herbs have an initial water content, varying between 45 and 95% and they are subdued to the drying process up to a water content generally lower than 14%. [4]

The operations order and the process running are similar to those used in convective hot air drying, into a drying chamber, the desiccating regime being intermittent, of charge type.[2] The medicinal and aromatic herbs are prepared depending on species and active parts type, being afterwards manually distributed in drawers. After having charged and closed the oven, the operating parameters are set. This process can be repeated any time is needed for any type of product.

#### **Technical characteristics:**

Oven type .....	stationary, closet-type;
Operating mode .....	automatic;
Heating system type .....	electric;
Supply voltage (V) .....	220;
Type of heating elements .....	infraceramic radiators FSR;
Number of heating elements (pcs.) .....	36;
Power of heating elements (W) .....	250;
Drying room volume (m <sup>3</sup> ) .....	2.01;
Type of drawers support .....	vertical, mobile;
Number of drawers (pcs.) .....	10/15;
Drawers useful surface (m <sup>2</sup> ) .....	0.48;
Type of ventilation installation .....	with hot air recirculation;
Type of fan .....	CMP-514-2M;
Power (kW) .....	0.18;
Rotative speed frequency (min <sup>-1</sup> ) .....	2700;
Air flow (m <sup>3</sup> / h) .....	1000;
Diameter of air recirculation tube (mm) .....	195;
Air refreshing system .....	cover with automatic control;
Overall dimensions:	
- length (mm) .....	1320;
- width (mm) .....	1172;
- height (mm) .....	2535;

Power (kW) ..... max. 9.6;  
 Mass (kg)..... 348

Among the preliminary operations of preparing the oven for the relevant tests, that regarding the maximum temperature setting by means of temperature regulator is an important one. Experiments have been made using both regulating algorithm types for temperature regulating device. It was noticed that, due to the system high thermal inertia for the bi-positional adjusting algorithm the registered average error between the set temperature and the measured value was  $\pm 5^{\circ}\text{C}$ , a too high value for performing a high –quality drying process. For the adjusting algorithm PID-type, after performing the self-calibrating operation, the registered average error was less than  $\pm 1^{\circ}\text{C}$ . This algorithm proved to be much more suitable for our type of oven. The temperature sensor having been used is of thermo-resistance type Pt. During the experiments it was remarked that it was in the benefit of the drying process that the air recycling system should continuously operate at maximum capacity and the slits of the air refreshing system should be open in order to allow the excess humidity removing.

The state parameters which define the drying process are the temperature ( $^{\circ}\text{C}$ ), humidity (%), drying speed (% humidity/min).[4] The material used in experimenting the EM of oven, consisting in celery and passion flower has been provided by SC Hofigal SA.București.

## EXPERIMENTAL RESULTS

Drying of medicinal and aromatic plants is one of the traditional methods of preservation of these products, which is imposed by requirements related to process, storage, transportation, use, etc.[1]

The celery *Apium graveolens*,L is known as a vegetable and spice. The material for drying consisted of leaves and stalks chopped of celery, with uneven appearance (fig.2a) was distributed equally in drawers (fig.2 b), in a thicker layer. The drying process was carried out at a temperature regime of  $40^{\circ}\text{C}$ , from an initial moisture of 78,93% up to a final moisture of 6,99%.



Fig.2. Minced celery:  
 a) material sample;  
 b) distributed in drawers, ready to dry.



Fig.3 Passion flower ready for experiments

Figure 4 presents the evolution of the state parameters according to the experimental data.



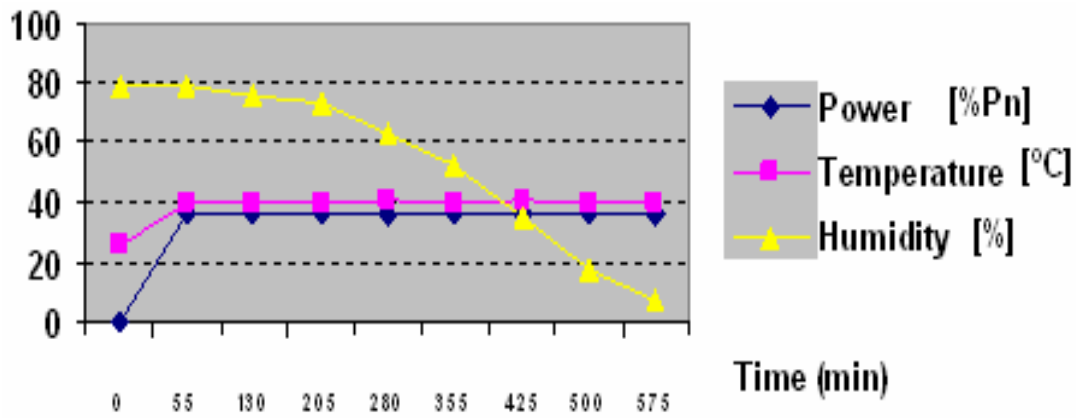


Fig. 4 Variation of the state parameters at the celery drying with EM of oven

Passion Flower - *Passiflora incarnata* has a calming action on the central nervous system, lowers blood pressure, is benefic against insomnia and prevents tachycardia. The leaves and the entire plant are used.

The material for drying constituted of fresh plant herb divided, was placed in drawers, 600g in each drawer ( fig. 3), the initial mass of the sample being of 9 kg. To keep the plant active

principles, this is dried at a temperature of max. 40°C.

Specific drying conditions for passion flower:

- Temperature (during the drying period with constant rate): 40°C;
- Drying degree from 67.34% up to 7.93%;
- Drying speed (during the drying period with constant rate) 2.143% Humidity / min.

The evolution of the state parameters according to the experimental data is shown in Figure 5.

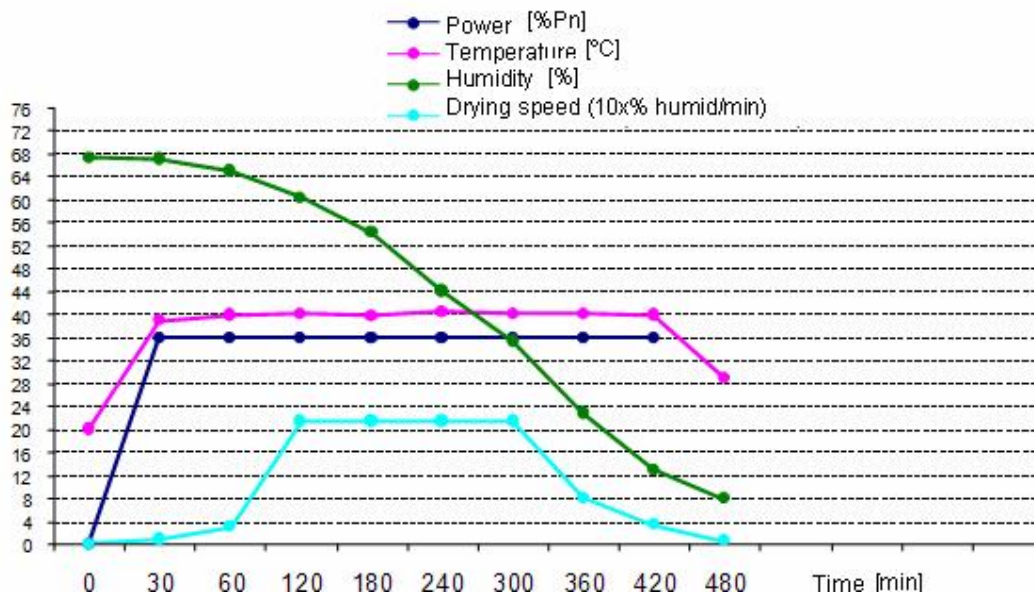


Fig. 5 - Variation of state parameters in the drying process of Passion flower

The artificially dried products were analyzed in comparison with the minimum allowable limits imposed by the applicable standards. The determinations were made using analytical

methods required by the technical specifications of SC Hofigal SA Bucharest, [5], in accordance with Romanian Pharmacopoeia and European Pharmacopoeia, the current editions.

The results obtained are presented in Table 1.

Tabel 1

Characteristics	Celery		Passion Flower	
	The admissibility limit	Results	The admissibility limit	Results
Heavy metals (Pb), ppm, max.	10	<10	10	<10
Total ash, g %, max.	8	6,9	13	8,5
Loss by drying, g %, max.	15	9	10	7,8
Total polyphenol content (expressed as caffeic acid) [mg% s.u.], min.	50,0	58,4	-	-
Total flavonoids content (expressed in vitexin) [%], min.	-	-	1,5	1,56

## CONCLUSIONS

Following the experiments carried out with experimental model of oven CE-0 could achieve and maintain any temperature <120°C (for drying of various medicinal and aromatic plants - temperatures between 30÷65°C). Due to the regulator temperature correctly set, stabilized regime temperature varies with max.  $\pm 1^\circ\text{C}$  against the set limit. Due to the thermal inertia of the main heating system, characterized by large radiating surface and uniform heat distribution, assisted by the temperature regulator, a reduced power consumption can be assured, according to the intermittences.

The corresponding values of the final humidities obtained in the process of medicinal plants drying make possible the subsequent operations according to the specific technologies.

Promoting of EM oven product would open new perspectives for:

- promotion of the recovery potential of medicinal and aromatic plants, which could be a solution for some family farms;
- favouring entrepreneurial initiatives in the field of medicinal and aromatic plants;
- improve the quality of the end product due to automation, monitoring and control of drying process;
- increasing rural family income through the involvement in the recovery of medicinal plants from spontaneous flora of

disadvantaged social groups (women, children, old people, etc.);

- enabling new investments in rural areas;
- possibility to export the production by specialized operators.

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# FERTILIZERS DOSES AND HYBRIDS INFLUENCES ON PRODUCTION AND TECHNOLOGICAL QUALITY OF SUGAR BEET

R. TAUS

I. GHERMAN

**Abstract:** In the current financial and economic context is necessary to improve the technologies of plant cultivation so climate change to affect as little the culture and fertilizers to be used correct. Research aimed: optimization of production factors to limit the effects of drought and other abiotic factors in order to obtain high yields of sugar per unit area. (Gherman, I, 2008).

**Key words:** Rizomania, Assimilation, Cercospora beticola;

## Research materials and methods

The research were conducted in 2007-2008 in experimental fields from NIRDPSB Brasov. The experience aimed to establish the determination of quantity and quality factors which have influence in the technological production of roots.

## Biological material

Were used 2 sugar beet hybrids from KWS firm, Chiara and Evelina.

The principale quality indicia of these hybrids are: High productivity, High sugar content, Low content K-Na-N in roots, Molasses reduced

Chiara is a diploid monogerm hybrid with double tolerance to diseases (Rizomania and Cercospora beticola). Type: normal mellitus. It's one of the firm KWS new hybrids, presents high genetic potential for roots production and maximum yield of sugar extraction. Is characterized by good plasticity under conditions of prolonged stress.

Medium roots production of Chiara in our country on demonstrative fields were between

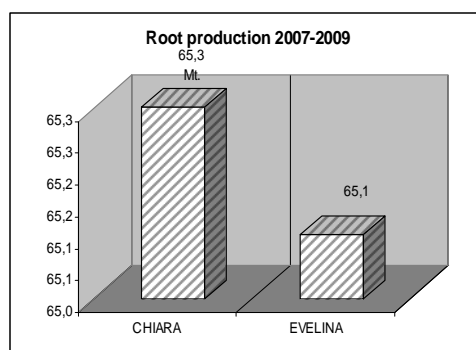
76,0 and 80,0 t/ha and 40,0 – 45,0 t leaves and tops and sugar content between 16,5-17,5.

Evelina is a diploid monogerm hybrid with double tolerance to diseases (Rizomania and Cercospora beticola), type sweet, is present in our country from more time. Is characterized by explosive springing field and ability to maintain foliage intact during vegetation. Assimilation capacity is large and the genetic potential of roots for production in terms of infection with Cercospora beticola is high. Medium roots production of Evelina in our country on demonstrative fields were between 74,0 and 81,0 t/ha and 42,0 – 47,0 t leaves and tops/ha and sugar content between 16,9-17,8.

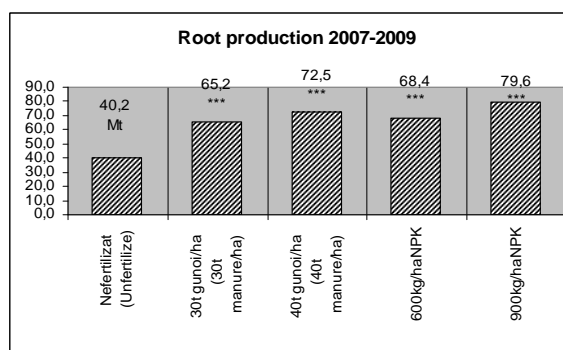
## Factors and graduations

Experience aimed to establish the fertilizer type which best meet the needs of plants. Factors in the study are the sugar hybrids and the fertilization variants.

Fertilization variants are with organic manure and chemical fertilizer. Were used 2 doses of manure and 2 doses of complex fertilizer 15-15-15.



DL 5% =4,5; DL 1% =6,2; DL 0,1% =8,5



DL 5% =5,4; DL 1% =7,5; DL 0,1% =10,4

Figure 1. Influence of hybrid ( B factor) on root production at harvest 2007-2009  
Figure 2: Influence soil resources ( A factor) on root production at harvest 2007-2009

**Factor A** : fertilizer variants with 5 graduations: a1 – unfertilized; a2 – (30 t manure/ha); a3 – (40 t manure/ha); a4 – (N-90; P-90; K-90); a5 – (N-135; P-135; K-135);

**Factor B**: sugar beet hybrids with 2 graduations: b1 – Chiara; b2 – Evelina.

### Results obtained

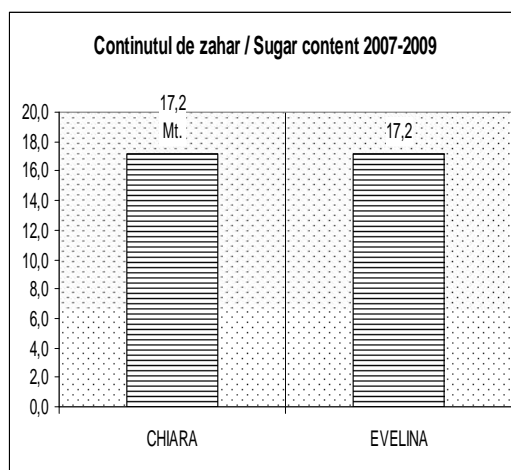
For highlighting the influence of factors on the production at harvest were assessed the roots production, the technological quality of roots, the sugar content and the biological sugar production.

As showed by the data presented in figures 1 and 2 hybrid factor does not significantly influence root production, output gap (3 year average) is only 0,2 t in Chiara favor.

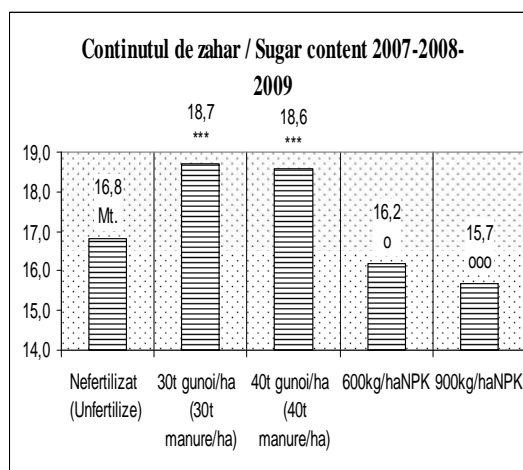
The soil factor had a very significant influence on the production of roots for all 4 doses of fertilizer. To the variant fertilized with manure 30 t/ha production increase with 25 t/ha toward unfertilized variant ( highly significant difference). Regarding the variant fertilized with 900 kg NPK 15-15-15 the production increase with 29,4 t/ha ( highly significant difference)

Table 1

Root production in tons Interaction soil resources x hybrid ( B x A ) (2007-2009)					
(Hybrids)	(Fertilisers)	(Root production)	%	(Difference)	(Meaning)
CHIARA	<i>Unfertilized</i>	<b>40,9</b>	<b>100,0</b>	<b>0,0</b>	<b>Mt</b>
	30t manure/h)	65,9	161,1	25,0	***
	40t manure/ha	73,1	178,7	32,2	***
	600kg/haNPK	68,5	167,5	27,6	***
	900kg/haNPK	77,9	190,5	37,0	***
EVELINA	<i>Unfertilized</i>	<b>39,5</b>	<b>100,0</b>	<b>0,0</b>	<b>Mt</b>
	30t manure/ha	64,5	163,3	25,0	***
	40t manure/ha	71,9	182,0	32,4	***
	600kg/haNPK	68,3	172,9	28,8	***
	900kg/haNPK	81,2	205,6	41,7	***
DL 5%=6,3		DL 1%=8,7	DL 0,1%=12,0		



DL 5% = 0,5; DL 1% = 1,1; DL 0,1% = 3,4



DL 5% = 0,5; DL 1% = 0,8; DL 0,1% = 1,0

Figure 3: Influence of hybrid (B factor) on sugar content 2007-2009 (%)

Figure 4: Influence of soil resources (A factor) on sugar content (average years 2007-2009) (%)

Data in table 1 shows the interaction of hybrids with fertilizers variants. Most important production of roots were obtained when the two hybrids were fertilized with 900 kg/ha NPK, Evelina obtained 81,2 t/ha and Chiara 77,9 t/ha, both making very significant increase compared with control unfertilized.

In figures 3 and 4 is represented the factors influence on sugar content. sugar beet hybrid did not significantly affect the sugar content, this is on average 17,2 / 3 years.

Analyzing the data in figure 4 shows that soil influence very significant the sugar content of beet. Such the variants fertilized with manure has sugar content exceeding 18% and variants fertilized with chemical fertilizers have sugar content near 16%.

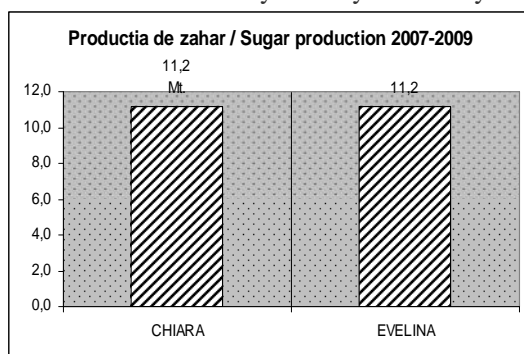
These differences are due to the fact that fertilization with large amounts of chemical fertilizers extending the growing period for roots and foliage in the detriment of sugar accumulation, causing depreciation of roots quality due to increased content of N harmful.

Table 2

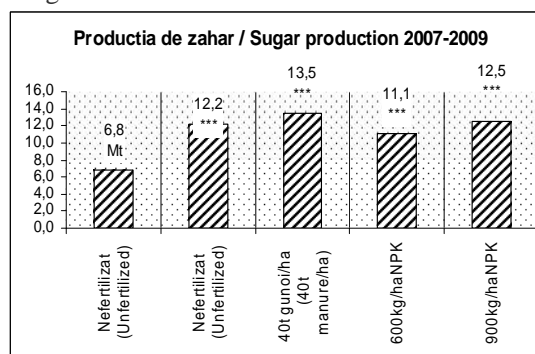
Sugar content (%)					
Interaction hybrid x soil resurces ( B x A) (2007-2009)					
Hybrids	Fertiliser	Sugar content	%	Difference	Meaning
CHIARA	Unfertilized	16,9	100	0	Mt
	30t manure/ha	18,7	110,6	1,8	***
	40t manure/ha	18,6	110,3	1,7	***
	600kg/haNPK	16,2	96,1	-0,7	oo
	900kg/haNPK	15,7	92,8	-1,2	ooo
EVELINA	Unfertilized	17,0	100,0	0,0	Mt
	30t manure/ha	18,9	111,5	2,0	***
	40t manure/ha	18,5	109,1	1,5	***
	600kg/haNPK	16,4	96,7	-0,6	o
	900kg/haNPK	15,8	92,9	-1,2	ooo
DL 5%= 0,5		DL 1%= 0,7		DL 0,1%= 1,2	

Analyzing the data in table 2 we see that in case of interaction between hybrid and fertilization sugar content is positively influenced in variants with manure and negatively in fertilization with chemical fertilizers. The higher average sugar content was recorded 3 years by Chiara hybrid

(18.9%) fertilized with 30 tons of manure. Lowest average sugar content was also recorded by Chiara hybrid (15.7%) fertilized with 900 kg / ha NPK. Difference in sugar content between the variants of fertilization (3.2%) was very significant.



DL 5% = 0,7; DL 1% = 1,6; DL 0,1% = 5,1



DL 5% = 1,0; DL 1% = 1,4; DL 0,1% = 1,9

Figure 5. Influence hybrid (B factor) on sugar production 2007-2009

Figure 6. Influence of soil resources (A factor) on sugar production 2007-2009

Data on biological sugar production regarding the factors influence are shown in figures 5 and 6. For all the 4 variants biological

sugar production is considerably higher than in unfertilized.

Table 3

Organic sugar production in tons Interaction hybrid x soil resources ( B x A ) (2007-2009)					
Hibridi (Hybrids)	Îngră șmănte (Fertiliser)	Sugar production	%	Diferență (Difference)	Semnificatie (Meaning)
	<i>Unfertilized</i>	<b>6,9</b>	<b>100,0</b>	<b>0,0</b>	<b>Mt</b>
	30t manure/ha	12,3	178,3	5,4	***
CHIARA	40t manure/ha	13,6	197,1	6,7	***
	600kg/haNPK	11,1	160,9	4,2	***
	900kg/haNPK	12,2	176,8	5,3	***
	<i>Unfertilized</i>	<b>6,7</b>	<b>100,0</b>	<b>0,0</b>	<b>Mt</b>
	30t manure/ha	12,2	182,1	5,5	***
EVELINA	40t manure/ha	13,3	198,5	6,6	***
	600kg/haNPK	11,2	167,2	4,5	***
	900kg/haNPK	12,8	191,0	6,1	***
<i>DL 5%= 1,4</i>		<i>DL 1%= 2,0</i>		<i>DL 0,1%= 2,7</i>	

Analyzing the data in table 3 shows that higher sugar production has been recorded by Chiara fertilized with manure 40 t / ha (13.6 t sugar / ha), followed by Evelina fertilized with 40 t manure / ha (13.3 t sugar / ha). The lowest sugar production per hectare has been registred to Chiara (11.1 t sugar / ha) fertilized with 600 kg NPK / ha.

### Conclusions

1.The greater production of roots average / 3 years (79.6 t / ha) was recorded by the variant with 900 kg NPK 15 -15- 15 commercial product / ha, followed by the variant fertilized with 40 t manure / ha (68.4 t / ha). All variants of fertilization have averaged / 3 years production increases statistically very significant compared to unfertilized.

2.The sugar content was heavily influenced by variants of fertilization in all three years of experimentation. Average/3 years highest sugar content (18.6%) was recorded by sugar beet fertilized with manure 40 t / ha. Ranked second was the variant fertilized with manure 30 t / ha with an average of 17.8% sugar.

3.Fertilization with both chemical fertilizer (600 kg respectively 900 kg NPK 15-15-15 commercial product/ha) determined a very

significant decrease in sugar content compared with control unfertilized.

4.Fertilization with 900 kg NPK led to extend the period of root and foliage growth at the expense of sugar accumulation, causing impairment quality of roots.

5.The highest average production of biological sugar/ ha was recorded to the variant fertilized with manure 40 t / ha (13,5 t sugar /ha). All four types of fertilization have registred on average/3 years very significant increases to the biological sugar production compared with untreated.

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## LANDSCAPE AND TOURISM

NICOLAE TULBAN \*

**Abstract:** *Landscape is the spatial background for all the human activities. For tourism though, it is both background and objective. As tourism became one of the main human activities – and this happened mostly in areas with valuable landscapes – the interest for the relation between landscape, tourists and inhabitants is raising. The integration of landscape in the cultural forms of tourism exceeds its aesthetic appeal.*

**Keywords:** *tourism, landscape.*

### 1. Introduction

Landscape is one of the key elements in almost any human activity. This is due to the fact that landscape is always both background for these activities as well as their result. If we consider the **settlement** as the spatial result of the human activities and the **landscape** the space in which these activities take place, we may find a special relationship between them. This relationship is the main subject for the following investigation.

In this context, **tourism** is a special sort of human activity. And above that, it "is the world's largest industry, generating a larger gross dollar output than any other single industry" (ARDELEANU 2010:113). The reason for this particularity may be found in the relationship that takes place in tourism between people and space. Almost all the other human activities are developed by and for people settled in one place – making the settlement their spatial expression as community. For this reason, they may be called as closed, self-oriented activities. On the other hand, tourism is an open activity – because it is oriented outside, to people that are not part of the given community. This impact between the place (including in this term the humans living it) and the strangers is one of the most important problems in the philosophy of the touristic sites. In the definition of this theme the landscape plays a major role, as it is, as we have underlined earlier, both background and result of the human activities (including tourism).

In this context, we shall investigate a complex ternary relation, between the place as container for the human activities, the inhabitants and the visitors. The place, as it will be seen further, is always defined by the settlement as a figure profiled on the landscape as background. Both of them, foreground and background, define themselves reciprocally through this relation.

Both of them lose their identity if this relationship is corrupted.

### 2. The Polymorphism of the Landscape

In the New Oxford American Dictionary, 2nd Edition, we find that **landscape** is "all the visible features of an area of countryside or land, often considered in terms of their aesthetic appeal". Based on this definition, the esthetic function of landscape is one of its most important. We enjoy the landscape mostly for its beauty, for its harmony, for the aesthetically pleasure we can obtain from it. Landscape is, in this understanding, first of all the aesthetic part of the concrete environment of our lives. And this concreteness is the intuitive three dimensional totality of everyday experience, free from any sort of abstractions. The value of the landscape renders itself visible only when we understand that we are not living in a homogenous and isotropic space, "but in a space distinguished by qualitative differences, such as 'up' and 'down'." (NORBERG SCHULZ, 1984:11). In this perspective, it is easy to see that any attempt to theorize the landscape remains pure theoretical, because the qualitative components of landscape cannot be quantified.

Landscape remains a particular form of the architectural space. It may be considered, so to say, a kind of *khora* – the primordial space found in Plato's *Timaeus*, the receptacle in which all the things may find their form. All man's buildings are erected in a certain relation with the landscape. This relation is the main witness for human culture, in its built configuration.

There is no visible landscape without man's intervention. For the simplest reason to make it visible, we can find the need for human constructions of any form, for example roads, paths, viewing points, etc. The natural landscape, in this context, may not be 100% natural and visible for humans at the same time. On the other

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hand, the built environment may dominate the landscape, making it impossible to be rendered visible. Our relationship is in this case very dimmed, but in no way will it be considered abolished.

Our interest focuses on this relation, as one of the main important resources for any kind of tourism. It must be understood, in the case of touristic areas, as exposed to a lot of interpretations. If we treat the relationship between buildings or built environment in a non-touristic area, its interpretation is linked with the people using it only. Turning our view to the touristic environment, we will find that the inhabitants are not the only men to understand their environment. The visitors are also interpreting the landscape and the buildings projected on it. So we face a cultural interference we have to manage. From this interference we get a lot of forms in which the landscape is perceived.

This interference witnesses for an understanding of the environment as a "totality made up of concrete things having material substance, shape, texture and color. Together these things determine an "environmental character" which is the essence of place." (NORBERG-SCHULZ 1984:14). In this understanding, landscape is becoming a comprehensive phenomenon. In general we may say that some phenomena form an "environment". But we must not forget that the concrete things which constitute our given world are interrelated in complex and perhaps contradictory ways. They all have their particular function in this complexity of our world. This function is always related with the functions of the other elements, all being "projected" on the function of the landscape. The functional approach is therefore fit only in a modeling purpose, because it leaves out the place as a concrete "here", having its particular identity. This "here" is given not only by the configuration of the natural environment, but it is also defined by the complexity of the world's elements in their particular way of life. And, supposing that it may be defined by this functionality only, it is anyway infinite – so the modeling effort is senseless. Moreover, there are a lot of "system components" that fail this functional approach. As the Swiss author said, "[...] nature also has another side: it offers the grace of growth and blossom. In the image of the golden tree, earth and sky are unified and become a **world**. Through man's labour this world is brought

inside as bread and wine, whereby the inside is "illuminated", that is, become meaningful." (NORBERG-SCHULZ 1984:64).

The systemic ecology approach implies that the environment is a very sensible system, in which the intervention of humans must be made with maximal care, following a detailed study of all the possible consequences that may appear in the model. As the ecology militants found, "The perspectives are that humans and nature are a single and unified system that can be described by ecological and general system concepts. These stand in contrast to the approaches of cultural-historical ecology and political ecology which apply ecological thinking to the non-human components of the system while applying social theory to the human components." (KNUDSEN, 2008:64). This perspective over the ecological points of view came after an older one, trying to overwhelm it, but with no significant results. As Wilson said, in the early sixties, "what we can say about these early nature philosophies – aside from the fact that they have been largely ineffective even on their own terms – is that they are reductionist. They invariably understand nature to be good and civilization – or, in the formulation of deep ecology, humans – bad. This is hardly the basis for a politics of social change." (WILSON, 1979:41).

A common line for these systemic approaches of landscape is that they all are trying to firmly separate the nature and the humans. This separation makes them fail. Nature, as Norberg-Schulz said, and as it was considered in all the old civilizations, is not the opposite of man. It is a part of it, a part of its life. Trying to identify and analyze the role of the landscape for any human activity, including tourism, in this hiatus is senseless. A better and more fertile approach may be the descriptive one. Investigating the space, environment and landscape concepts, we may find a lot of dichotomies trying to define the landscape. They are not separations. They are made for methodological purposes only, because the final intention is to prove, through them, the unity of our world. These dichotomies, analyzed and applied in the right way, may be more productive for our purpose - to describe the relationship between tourism and landscape, understanding here landscape as a complex made by the natural environment, the built one, together with their inhabitants, together with their inhabitants' activities, as dynamic factors of influence.



The first dualism may be found between the virgin and anthropic environment. The first one is not listed here only in the need of protection. For our elders, it was defined as the 'territory beyond the limits'. The need to 'attack' and to 'conquer' it appeared only through the Renaissance – starting with the great conquerors. In the same time, man thought that he has no limits, that the whole territory belongs him and must be conquered. Not the same happens by, for example, in case of our traditional communities. Here we face a protection of the virgin landscape 'by default'. (PAPADIMA, 2008:96). There was no need to step outside the community space. For those who had to do this, it should be a great and unpredictable adventure, and their ground must be very hard to exit the stable space.

On the other side, the search for the aesthetic appeal in nature appeared late, in the second half of the 19<sup>th</sup> century. At that time, there were made the first interventions (in US and the Western Europe) in order to protect valuable landscapes/seascapes. The virgin landscape has to be protected, artificially, because the old, 'protective' way of life disappeared. Here we may find an important resource for eco-agri-tourism: the integration in the environment, beside landscape, the communities' tradition, folklore, etc.

Tourism comes with another polarization, between host and stranger. To enjoy the landscape in the inhabited areas, this relation is determinant. The man's integration in dwelt areas – the hospitality – was one of the main themes of philosophy, in the '70-es of the last century. (DERRIDA 1999). The contact between men and remote landscapes must be the main concern for a healthy philosophy of tourism. In this context, this is very important for a real understanding of place, of landscape in general. Sightseeing only gives us a very limited image of the landscape. The integration in the environment, supposes completion with all the stories about it. These stories are the link between the strangers (the tourists) and the hosts (the natives). The aesthetic understanding of landscape, in the absence of its codes, is superficial, even if it is sustained by contemporary theorists, modeling it (WILSON, 1992). These codes are formed by the legends, the stories related to some particular natural monuments, but – first of all – by the lifestyle of the natives. For a full living of the landscape's beauties, for a perfect link between tourism and landscape, for the best understanding of the

place, we must integrate the aesthetic appeal with the dwellers' culture.

The difference between the central and the linear space is also important for a good perception of landscape. The dwelled spaces, with their intrinsic centrality, are some of the major elements perceived in almost all of the forms of landscape. The harmony between the built and natural environment represents one of the main points of an interesting landscape. The linear space of the travelling routes may determine a good landscape. In our dynamic society, the linear space of the transportation routes has an increasing importance in the perception of space. Their importance is bidirectional. First, their 'active' function is given by the images the tourist may obtain walking or traveling along them. These images build the tourist's first impression about the traveled countryside. In the planning activity, the layout of these routes must be drawn considering this criterion as one of the most important. (CANTACUZINO 2001:16).

But the most important dualism is that between the sky and the earth. Philosophically, this tension was introduced as fundamental by Heidegger, saying: "earth is the serving bearer, blossoming and fruiting, spreading out in rock and water, rising up into plant and animal [...] The sky is the vaulting path of the sun, the course of the changing moon, the glitter of the stars, the year's seasons, the light and dusk of the day, the gloom and glow of night, the clemency and inclemency of weather, the drifting clouds and blue depth of the ether!" (Heidegger, 1979:149).

### 3. The Touristic Importance of the Landscape

The relation between landscape and tourism is a complex one. For tourism, the landscape plays, as we have seen, mainly the role of a background. We may find touristic activities in which landscape plays the main role, as well as forms of tourism in which the landscape's role is secondary. The landscape is not important for tourism in the outdoor and recreational activities only. In the latter forms, the importance of landscape is bivalent. First, it is always behind of the other interest centers; on the other hand, it has a strong connection with the relationship between the landscape and built environment.

The natural landscape is the main objective for the outdoor activities. This form of tourism has a strong connection with the beauty of the landscape, as landscape is one of its main targets. Obviously, this happens always when we face

landscape directly. But when the landscape's value is increased, its attractiveness became higher. This is the reason for seeing the landscape as a very important resource. And further, the need for protection. Considering landscape a resource for tourism, it appeared, in the 19<sup>th</sup> century, the need to protect it, creating and managing special protected areas. This is made centralized, by the government authorities. There is a classification of Worldwide Protected Areas following IUCN Management Categories, in which we may find six categories (ARDELEANU 2010:114) of protection for these areas, from the most protected (with no touristic use) to those that are managed mainly for the sustainable use of natural resources (mainly touristic use). In this classification, the landscape plays a crucial role. Its value is important, more or less, in all these categories. Its importance reaches its maximum in the Category V: Protected Landscape/ Seascape: protected area managed mainly for landscape/seascape conservation or recreation.

The natural landscape plays an important role in the other forms of tourism, too. As background, the landscape hosts the projection of the human activities of the community living it. These activities must be considered in their integrity, because almost all the human activities have, more or less, impact over the landscape. This impact ranges from the minimalist intervention made in the protected areas, to the maximal impact in case of, for example, urban development, highways, etc.

Playing this role, one can say that the landscape is the mirror for the community's way of life, as it has been developed through the years, decades or

centuries. This enriches the landscape with a huge cognitive, historical, social value. Moreover, these values are rendered visible in the most sincere way.

The "pecuniary" interaction between tourism and landscape may be important for many reasons. From the tourism operators' point of view, the value of landscape may be useful to generate revenue, for economic activity, research, long-term and sustainable development. For the inhabitants, the benefits are given by the economic growth of the community, the economic activity generated; increase of employment level, the openness to others, the interactivity with strangers. And, last but not least, for the visitors and other users, the benefits are given by: enhancement of their personal experiences, social interactivity, openness to new knowledge, family bonding or team building, time and cost efficiency.

#### 4. Conclusion

For tourism, landscape is one of the main resources. In order to be protected, it must be completely understood. Its multiple meanings exceed the aesthetic pleasure and the need for protection. Almost every place on Earth has a story. These stories compose the spirit of the place – that thing that Romans called *genius loci*.

The landscape tells us more if we listen to its stories, its legends. And listening, we will find that we are indebted to protect it, in order to keep our links with the spirit of the place, because in this spirit relies the landscape's main value.

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# ARCHITECTURE AND TOURISM

Nicolae TULBAN

**Abstract.** *The relation between tourism and architecture is bidirectional. On one hand, we have architecture monuments that, due to their history, their beauty, their celebrity became touristic objectives. On the other hand, we have architecture in the service of tourism. Both subjects present interest for the touristic activity. For this purpose, both have to be studied from an interdisciplinary point of view.*

**Keywords:** *tourism, architecture, contemporaneity.*

## 1. Introduction

As any human activity, tourism is instantiated in our living space through buildings. For them, the need of architecture is obvious. On the other side, architecture, as spatial instance of human activities, is the only spatial record of our history. The perception of the built space as corporal history is one of the main ways to knowledge and, in the same time, one of the most important reasons for the touristic activities. In the same time, contemporary architecture is one of the clearest proves of the civilization and technological niveau a community has attended. In this view, architecture in a countryside is one of the clearest and easiest to perceive images of the history and life of the community living that territory. Having this importance, care and protection are the only actions that community must to take regarding it. This actions are oriented to the monuments or the old buildings only. They must be present, first and foremost, in the planning politics for the whole territory.

In this perspective, the most important objective in order to preserve the architecture as a message carrier over times is to preserve its atmosphere. This can be made in a lot of ways, but all of them are starting at these urban politics. As most of the valuable architecture objectives may be considered as touristic objectives, the touristic side of the urban politics must be consonant with the architectural and city-planning ones, in order to get the best harmony of the whole.

On the other hand, tourism needs architecture not only as objective, but also to create the new spaces demanded by its fast expansion. We have to distinguish here between outside and inside. They are defining one another, reciprocally. Inside, the buildings for tourism must face the increasing demands for our days' tourist, offering them the best comfort they

expect. The interior architecture of the hotels, restaurants, etc. has to be always at the highest level. Outside, what has to be kept in mind is that buildings erected for touristic purposes do shape the landscapes and living environments of the inhabitants, and, in the same time, models the tourist's perception of these surroundings.

## 2. Tourism for Architecture.

The interference between tourism and architecture is a complex one. The continuous expansion of tourism we faced after the World War II faced architecture continuously with new problems. The dynamics of the contemporary society came with new and new demands for architecture and city-planning. In the same time, the communication technology, the increasing possibility to 'preview' the places in the most accurate ways is altering the tourist's perception of the destinations. Regarding these, we face a bidirectional powerful influence between the new architecture and tourism, being forced to consider at its real importance the reciprocal relationship between the modern practice of tourism and the built environment. Under this pressure, everything from historical monuments to exotic holiday destinations has been redesigned and packaged for mass consumption. Through the required arrangements, the masses of visitors redefine the monuments' interior and exterior spaces and the atmospheres. This metamorphosis must be careful controlled through the development plans, because, left on their own way, the spatial character, the *genius loci* residing in every specific sites may become re-conceptualized – and this is really unavoidable. Some of them may remain preserved and celebrated, others may be directed, through uninspired projects, right to decay.

In this context, the first problem is the relation between old and new in the sites where

there exists architecture with considerable historical value. Here, the main function of the new must be the continuation of the old, referring here on one hand, the restoration, renovation, rehabilitation, conversion of the existing old buildings and, on the other hand, the erection of new buildings in old contexts. We must not forget that architecture is a strong means of expression that affects its spectators emotionally. Furthermore, it sets the framework for rational examination. High quality architecture augments the cultural value as well as the experience value of a product. Only in this manner, paying attention to this relation between new and old, the passing time adds value to both the existing and the new buildings, making them, after years, architectural objectives. In our days, we face an increasingly difficulty to obtain this consonance between old and new. This is because we have a raising tension between the value of tradition, on one hand, and the pressure for universalization and globalization, on the other side. Facing this situation, the theory of architecture developed a new concept – the '*Critical Regionalism*'. As the American architectural critic Kenneth Frampton said, 'The term "*Critical Regionalism*" is not intended to denote the vernacular as this was once spontaneously produced by the combined interaction of climate, culture, myth and craft, but rather to identify those recent regional schools whose primary aim has been to reflect and serve the limited constituencies in which they are grounded'. (Frampton 2006: 314). Even if it seems this is a problem specific to the architects, solving it for the sites where tourism is a key activity is impossible in the absence of the tourism professionals support. For these regions, the multidisciplinary teams, compose of architects, tourism professionals, city planners, sociologists, historians, etc. are the main voice in the development of the coherent of sustainable politics. For such teams, the critical regionalism approach, as it has been defined by K. Frampton and the French philosopher Paul Ricoeur is one of the most fecund choices.

For these teams, one of the main problems is the relation between the touristic endowments and the architectural objective. In the increasing tourist industry of our days, this theme becomes a very sensible one. The term 'endowments' comprises all the buildings necessary for a good touristic functionality. We include here everything is added to the existing built environment for the touristic purpose, from parkings, access roads, waiting spaces, entry

buildings, museums (linked to the existing touristic objectives etc.). To be perceived at its fullest value, the touristic objective (not only the architecture monuments, but also landscapes, touristic places, archeological sites, etc.) needs, naturally, the necessary endowment, specific for our times. This runs unavoidable to a considerable alteration of its genuine character. To configure the interior and exterior spaces needed for this touristic add-ons must be made with plenty of professionalism, in multidisciplinary teams, because the risk to loose the spirit of the space, the *genius loci*, is very high. The interference between the old – the existing, historical architecture we intend to valuate in touristic purposes – and the new – the touristic endowments needed – is a very fine one. Configuring its spatial instance is a difficult task, with which the multidisciplinary teams named before are confronted.

The hidden problem of these endowments is the challenge of architectural expression. It does not apply to those constructions only. Its value is the same for most of the new buildings to be erected in touristic sites with valuable architecture. This hidden problem is maybe the most profound and critical one in the touristic areas, and it has a lot of fa ettes. One of them, and maybe the main one, is that the architectural expression must be tuned with both today and yesterday, in order to have value tomorrow. To gain this objective, it is important to use all of our possibilities, including here the old and the newest materials, the old technologies and our technologies and so on. But to use them means to know them. This way only it is possible to continue the old construction technologies, adding them new and new competences and competitive advantage. To valuate the tradition, there is no need (and it may even be toxic) for technology import. Keeping the line with the new technology has not to be made importing it at any price, but through competence assimilation. In such a way, the contemporary architecture maintains naturally its roots in the traditional one. Doing so, we shall not face a petrified traditional architecture as much as we shall not have an impersonal contemporary architecture. The example of the Vorarlberg Ministry for Economy and Work Programme for Architecture and Tourism is conclusive: '*Through the example of the "Bregenzer Wald" (western region of the federal state of "Vorarlberg") a particular correlation between contemporary architecture and regional value added can be seen: The*

*regional building industry distinguish themselves through a **handcraft tradition**. Furthermore, those businesses meet the challenge to develop new techniques and solutions for new structural and design ideas / problems. As a result the regional building industry of the Bregenzer Wald has an excellent reputation internationally due to a constant augmentation of competence and competitive advantage. Hence, contemporary architecture is a source of regional development and adds to the competitiveness of a region.'* (Pla'tou 2007).

This approach may not be use for the selection and development of the architectural and construction techniques only. The same algorithm may be use in the selection of a traditional vocabulary of architectural forms that can be seminal for development to a contemporary use, integrating it with the contemporary functions – touristic or not – gaining this way the architectural expression of our days. For touristic purposes, this problem (which seems to be solely an architectural one) is crucial, because it may assure the perpetuation of both the architectural value and the contemporary comfort, assuring, in the same time, the touristic attractiveness of the monuments.

But, above technology and materials – as they participate for it – the most important architectural element in order to preserve the character of the touristic valuable historical sites is their atmosphere. The key to preserve the historical ambiance is that, through unavoidable changes in the historical sites, the changes in the atmosphere to be made quasi-statically. This can be made only considering – paradoxically – the site as part of the building. The building has to be rooted in its context – built or natural environment – in order to have a good relationship with it. We must tend, as K. Frampton said, to '*a consciously bounded architecture, one which rather than emphasizing the building as a free-standing object places the stress on the territory to be established by the structure erected on the site. This 'place-form means that architect must recognize the physical boundary of his work as a kind of temporal limit – the point at which the present act of building stops.*' (Frampton 2006:318)

To gain this, the site must first be known and understood. This must happen with all of its characteristics, ranging from the topography, as the three-dimensional context in which the building must be erected, to the very complex way the art of building in the neighborhood is

practiced. This may be presented considering the site as a multidimensional space, in which the three-dimensional cartesian space is only a part. We may consider the other the cultural, occupational, spiritual, esthetical, traditional, etc. as the other dimensions of this space. In this perspective, we have to consider all the determinants that contribute in the configuration of the architectural form, because a building is developed on all of these coordinates, not on the three cartesian only. This way it is easy to understand why and how the architecture is configured by the whole human lived space. It is so because first of all architecture serves all the man's life, because nothing is build with another purpose.

But, secondly, architecture, through its expression function, speaks further about all of this dimensions, about all of the aspects of human life. Through architecture, all the above-mentioned dimensions remain alive through time because with the architecture's help we understand over years the man's living space in all its complexity. This understanding, further, forms us and our lives. In this way we may say, reciprocally, that architecture configures not only the visual space, but these complete space in which man lives.

In fact, this may be the strongest link between tourism and architecture. And here resides the reasons that transform architecture in touristic objectives. Architecture is the easiest and the most facile contact between a stranger (the tourist) and a community, in order to understand each other.

### 3. Architecture for Tourism

Commuting the terms, another challenging concern is how architecture may serve tourism in its other forms, not the 'cultural' one. It is clear that, as any human activity, tourism has a big amount of demands from architecture. In its unstopped development, tourism expresses its needs of increasing complexity. The spaces for the hotels, restaurants, leisure activities, are all important problems for the architects. But the architecture themes for tourism are clear. We have clear prescriptions about the needs for all touristic buildings. They are all standardized, in almost all touristic countries.

In the same time, we are facing with a strong request for high quality architecture from the tourism side. The increasing customers' requirements and the increasing variety of

customers in tourism are rising the standards the architecture must comply. On the other side, the quality of the environment, the need for personality, the versatility are few of the contemporary demands for the tourism architecture. '*Contemporary architecture generates public attention through media and first adopters and becomes the central element in the word-of-mouth equation. An attractively designed environment represents life style and zeitgeist, which augments the attractiveness for businesses and incentive offers.*' (Pla'tou 2007) The quality of the atmosphere is proportional with the quality of architecture. This happens for the simplest reason that a good architecture is developed over more of the above-mentioned dimensions. This makes the atmosphere denser. And a denser atmosphere manages to move easier people. Superior atmosphere attracts customers who value quality during leisure time and holidays highly. (Zumthor 2005:11).

This increasing value of atmosphere in architecture hides a behavior kind among the guests. The atmosphere is the spatial instance of the overall experience of the guest. Here the efforts of the tourism manager (in order to create the best experience for his guests) are conjugated with the efforts of the architect to create the best atmosphere possible. Their success is guaranteed by attractive product design, ambiance, successful communication and, not at last, reasonable price setting. Here may be seen the role played by the contemporary architecture. In Austria, in Vorarlberg '97 % of the interviewees confirmed the expectation that "contemporary architecture can be used as a vital marketing tool" and 95% approve the expectation "attractiveness for new customers".' (Pla'tou 2007).

For the nounce, the importance of architectural expression in tourism industry is proved. An investigation in this direction becomes necessary. Architecture can be used as a topic in communication, not only as a mean to build shelters for guests. The creation of the spatial atmospheres is the first step in the direction of the holistic touristic product, because today this is a key condition for the client to experience it to its full potential. Style and quality are communication means addressed to certain target groups of customers. They can tell, through architecture, a lot of stories, directly or via impressions.

A clear concern in this direction drives us to an very common concept for our days: corporate

identity. Because architecture contributes substantially to the guest's overall experience, we are aware of the existence of a certain corporate philosophy, as it defines the atmosphere themes. To gain the coherence in order to formulate such a philosophy, the development of the touristic concept must be closely coordinated with the business, marketing and, not at least, the architectural expression. This happened because the architecture may be understood as the spatial instance of this philosophy, as it integrates all the space, atmosphere and ambiance generators. The landscape, the tradition and innovation, as well as regional spatial structures are all gathered together by spatiality, by architecture, in this process of integration. And this must be seen everywhere, for example in the building surroundings, interior space, furniture design, the logos, the corporate design, even if this remembers the wrightian *opera completa*. As this process has to take place in contemporary forms – because, for example, the contemporary architecture and technology is a *lingua franca* for the our days' guests – the importance of architecture for tourism is proven, as we can say that it instantiate, spatially, our way of life.

#### 4. Conclusion

Here we can close a loop regarding the use of history in the contemporary architecture. The relation between architecture and history have no more to be made regarding to the past only. First of all, we must understand that what we are building today the heritage of tomorrow. If our building is related to the old ones, our message to the future is the complete one. The involvement of history and contemporary architecture in the same work has the potential to differentiate it from competitors. This way is the only one which leads to a coherent passage of the buildings in time, assuring us that our architecture is linking coherently our way of life, the past and the future – its main goal.

In Austria, the most important economic key ratios regarding extension of buildings and reconstruction of buildings by using contemporary architecture was positive, as 80% of the entrepreneurs regard contemporary architecture as an essential marketing factor – because good architectural composition is something special and unforeseen. (Pla'tou 2007). The value of the synergy between tourism and qualitative contemporary architecture manifests itself as the basis for the touristic success of a

destination, and therefore influence its economy and society. This fact guarantees that in the long term, the European tendencies are to bring the sustainable tourism development through

contemporary architecture and design, considering that this architecture has the possibilities to enlarge the cultural offers

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## IMPLICATIONS OF MAKING A VOLUNTARY HOTEL CHAIN IN BRAȘOV AREA

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**Abstract:** *Voluntary chain brings a lot of benefits to both partner tourist structures and where they are located, such as promoting these specific structures and increasing their credibility towards customers. In Romania, voluntary chain concept is a new and emerging one, which hasn't been applied so far. The purpose of this paper is to present the idea of this system in Brașov.*

**Keywords:** *Tourism, voluntary chain, hostel, advantages.*

### 1. Introduction

The voluntary hotel chain is a voluntary union of independent hoteliers which promotes and develops a unique brand of the group, although the hotelier product offered can be differentiated from the point of view of architecture and decoration, but this is nearly homogeneous from the point of view of comfort and service.

Starting with the eighth decade of the past century, it was registered a great rise about creating voluntary hotel chains (independent hotels associations), as a defense reaction to the extension of integrated hotel chain.

However, a basic principle of chain structures is common use of specialized services. Usually, the initiative of making a voluntary chain belongs to a group of hoteliers from the same area and who aims to provide a relatively standardized product, defining a number of compulsory criteria which have to answer acceding hotels. Gradually, those hotel chains can be extended, receiving adhesion of the same country or even more countries, getting in this way an international character. Adherents of a voluntary chain keep their legal and financial independence. But there are adopted and applied common commercial and promotional strategies. From this reason, voluntary hotel chains was called advertising chains. Usually, hotels acceding to a chain keep their initial name, but they add the new logo. At the level of each voluntary chain is called a new legal person (either as a commercial society, or as a non-profit association), distinct founders.

A very important aspect is that how can join new hotels, in the same way others can withdraw from the chain, and others can be excluded, due to poor results observed in the controls. This severe controls assure, actually, the success of a

chain objectives. There are many situations where hotels acceding belongs, in the same time, from many voluntary chains.

#### Advantages

From the most important advantages, and services which can be offered to acceding hotels from a voluntary chain, can be mentioned the following:

- **Making promotional campaigns and editing guidelines** including all acceding hotels, these materials are widely disseminated in acceding hotels, through travel agency;
- computerized reservation office;
- association to the voluntary chain of companies providing equipment or food and obtain preferential prices in relations with agreed suppliers;
- providing technical assistance and management consulting from specialists employed by the chain;
- obtain financing on terms more favorable;
- washing bed linen;
- unable to practice tax evasion;

#### Disadvantages

- inhomogeneous product and less coherent brand image if the number of adhesion is too high;
- limited possibilities for action if the number of adherents is too small.

### 2. The concept of voluntary chain in France, Inter Hotel

Un interesting and special example of voluntary chain is Inter Hotel chain, group created in 1968, as a initiative of some independent hoteliers from south-west of France and which, in 1996 already had a number of 174 two or three stars hotels. Although created as a

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non-profit associations, that chain turned later (in 1988) in joint stock company, based in Paris, where proposed reservation central operate too. The chain has a Supervisory board, composed of elected hoteliers, representatives of the regions of France, from where affiliated hotels come. This supervisory board calls management executive of the chain.

Inter Hotel concept, related to traditional hotel image, has as key words quality, tradition and personalized service. Although, claim that chain is that is different to integrated chains by providing a personalized service in each of its hotels located in cities center or along the travel axis providing a warm welcome, respecting identity card chain. The acceding hotel has to respect quality standards imposed by the chain. So, in order to provide quality benefits are defined certain standards of comfort which have to be respected.

Promoting “chain spirit” involves important brand promotion efforts from each hotel, in collaboration with based chain and with reservation central. In fact, the hotelier agrees to follow the guidelines and decisions issued at the chain, this “chain spirit” doesn’t mean to loose the identity of each acceding hotel, which keeps its own identity, based on the idea of “diversity in quality”. Although, the slogan of the chain is “Tous ensemble, tous différents” ( “all together, all different”).

The chain has the right to control the acceding hotels, to protect the costumers. Also, a “surprise” quality control is made, annually, by a specialized cabinet. The result is that from the 100 also controls were excluded 4 hotels from the chain, so the “zero defects” operation acquires a concrete content as possible as it can be.

Tariff policy applied is relatively uniform, being accepted by the hoteliers. Moreover, 100 from the chain hotels accepted even the rule of unique tariff, differentiated on comfort categories (two and three stars). Also, for the costumers traveling on professional interest (on duty) are offered packages services including bed and breakfast or half-board, at special prices, and these receive discounts up to 20% from the rate shown.

Communication activities of the Inter Hotel chain include: advertising, sales promotion, public relation, sponsorships, exhibitions.

So, the chain edits its own guideline, with a circulation of 250,000 copies, with national and international edition, half of copies being

distributed to the adherents, and the other half of copies to the clients.

Regarding mass-media advertising, the chain uses specialized magazines, both in France and abroad. Also, advertising is made through promotional material published by *Maison de la France* (national body that deals with promoting France as a tourist destination).

The chain has established a number of partnerships: with a airlines company, which assures promotion of the network on the line Paris-Nice, making advertising on hours and aircrafts, with a national trade union confederation, which organizes all the congress in partnership with Inter Hotel chain, and with a company specialized in car rental services (rent à car).

Inter Hotel sponsors many sportive manifestations: motor racing, motoring, sailing sports. Also, the chain sponsors TV games and competitions, broadcast on prime time, offering prizes consisting in stays at acceding hotels.

In public relation domain, the press service of the chain informs the general public and the domain specialists about the chain and adherents actions. Brand image and reputation of the chain are sustained by editorial articles. The chain has a domestic journal, entitled “InterEcho”, through it is made the communication with the adherents.

The active participation to the most important exhibitions or fairs of tourism from France or from others countries determines strengthen of the homogeneous image and of the awareness of the chain.

For marketing services of the chain, at its headquarters works a team which makes activities like:

- development of field studies;
- marketing actions, like transmission of personalized offers services;
- negotiation, conclusion and follow up the contracts with suppliers, carriers, with major travel agency networks;
- insertion of posts regarding chain hotel in hotels and tourist programs catalogs of tour operators from different countries, issuing travel to France.

Central reservation of the chain works in real time, being computerized, allowing confirmation of booking online orders. There is, also, one reservation desk in Germany and Grand Britain, which makes booking-activities for chain hotels in those countries.

Bookings can be made directly, at each hotel, at a hotel for another hotel of the chain (free service

offered, very useful in case of a tourist circuit), and electronically too.

The large number of hotels belonging to chain is an important purchasing power, which allowed obtaining significant reductions in purchase prices.

The furnishing central of the chain proposes 70 agreed suppliers, who offer promotional prices. Each acceding hotel receives a supply manual, which includes suppliers coordinates, products, prices and outlets of these products.

### 3. Amount of tourists in Brasov during 2001-2009

Still, it will be made a short presentation of the tourism evolution in Braşov area in 2001-2009.

In 2001-2009, most tourists who visited and practiced different forms of tourism in the city are Romanian. The interest of foreign tourists for Braşov increased, but slower. The total number of tourists increased from year to year.

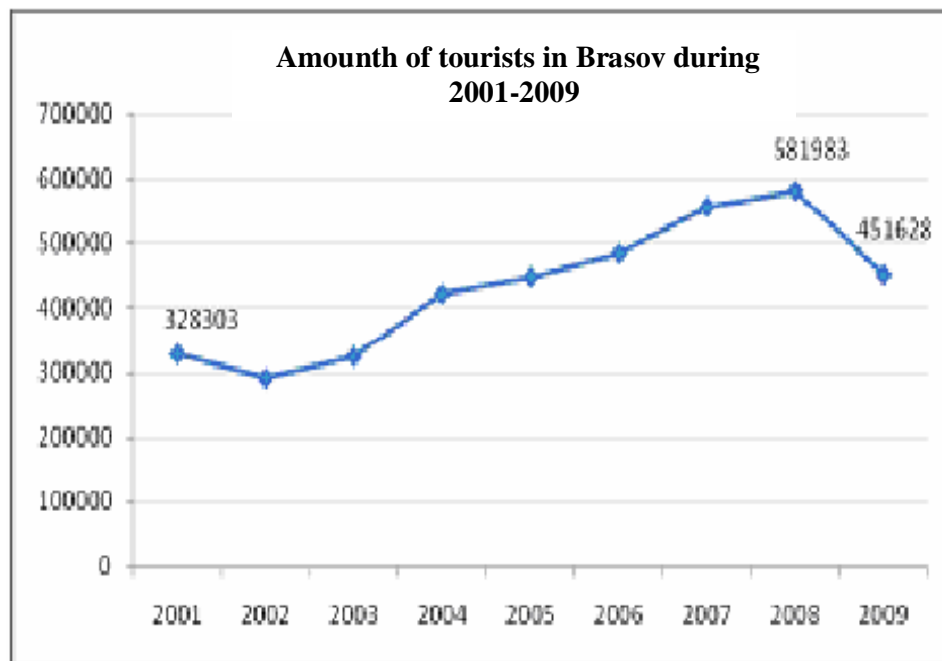


Fig. 1. Amount of tourists in Brasov during 2001-2009

Although in 2009 in the current economic crisis the number of tourists declined compared to the peak year 2008, the number of tourists grow up with 37,6% compared to 2001.

Table 1

The evolution of tourists in 2001-2009

	2001	2003	2005	2007	2008	2009
<b>Total tourists</b>	328 303	324 816	448 147	556 816	581 983	451 683
<b>Romanian tourists</b>	260 014	251 070	359 259	452 586	480 422	376 716
<b>Foreign tourists</b>	68 289	73 746	88 888	104 230	101 561	74 967

The number of foreign tourists in 2009 represented 17% from the total number of tourists who visited the city.

### The distribution of foreign tourists by country of origin in 2009

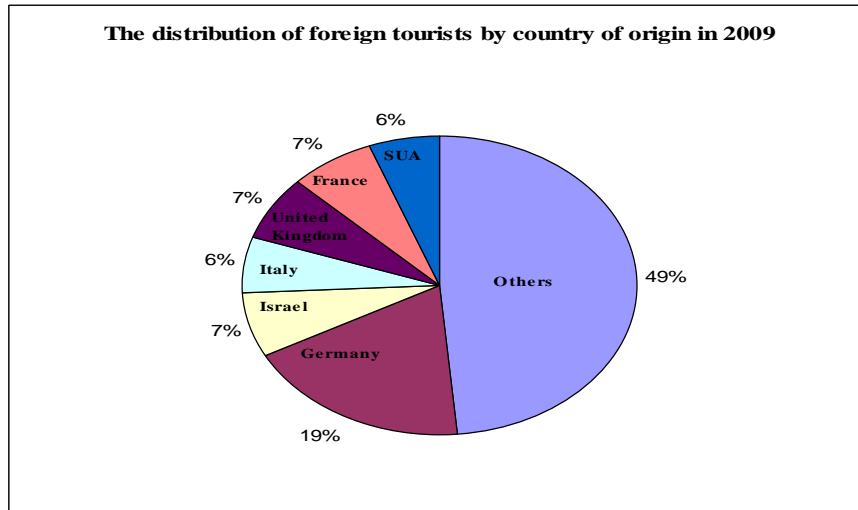


Fig.2. The distribution of foreign tourists by country of origin in 2009

Starting from 2000, most numerous foreign tourists come from Germany. This trend continued in 2009. The amount of tourists is closely related with the number of investment developed by German investors.

The main destination of tourists is: Braşov city, where in 2009 arrived almost half (48%) of the total of tourist who visited the city; Predeal city, and Bran-Moeciu area are the following locations frequented by tourists.

Table 2

The Distribution of Tourists According to Destination, 2009

	Romanian tourists	Share of Romanian tourists	Foreign tourists	Share of foreign tourists	Total tourists	Share of total tourists
<b>Braşov City</b>	161 463	43%	57 022	76%	218 485	48%
<b>Predeal</b>	101 479	27%	5 220	7%	106 699	24%
<b>Bran-Moeciu</b>	50 555	13%	6 211	8%	56 766	13%
<b>Others destinations from city</b>	63 219	17%	6 514	9%	69 733	15%
<b>Total tourists from city</b>	376 716	100%	74 967	100%	451 683	100%

**Tourist structures from Braşov county**

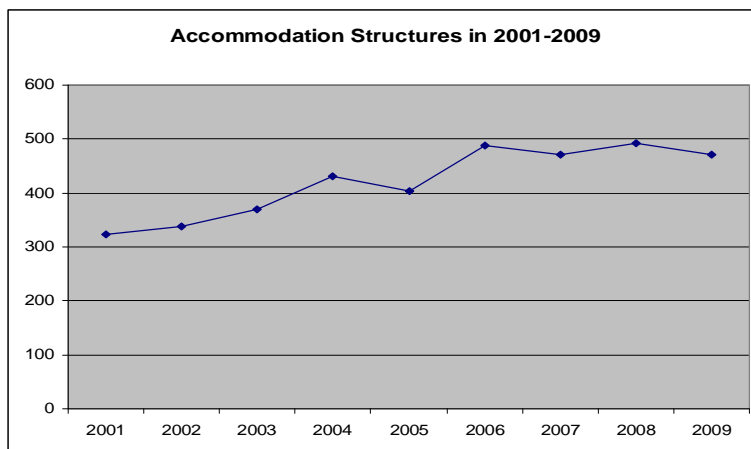


Fig.3. Accommodation structures 2001-2009

Accommodation infrastructure is represented by hotels, inns and motels, villas and tourist chalets, bungalows, holiday villages, campsites, camp students, pensions (urban, rural and agri-

tourism). The number of tourists structure from city increase with 32% in 2001-2009.

**Accommodations units in Braşov county**

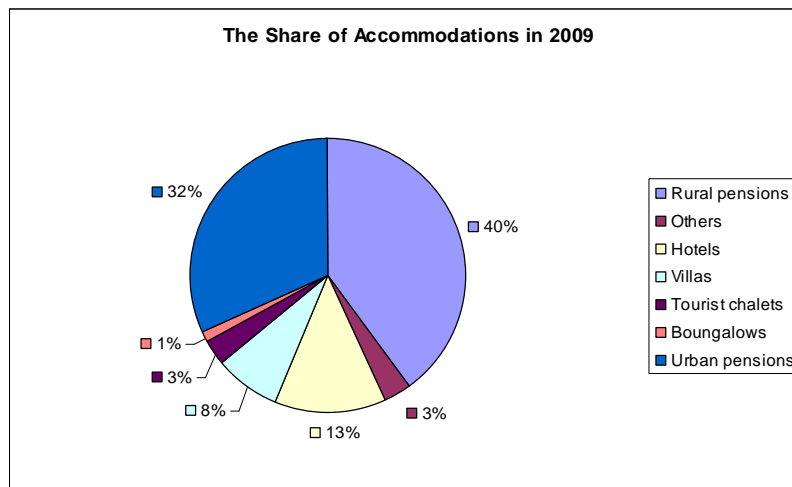


Fig. 4. The Share of Accommodation in 2009

This increase was registered first of all due to large number of built pensions both in urban and rural area. In 2001 there were 183 pensions (both in urban and rural area), and in 2009 just in rural area there are 187 pensions.

From the registered dates shows that Romanian tourists, like the foreign tourists who accommodate in the city structure prefer the hotels. This thing can be explained both of bigger number of places available and the possibilities of entertainment (pools, spa).

The total number of overnights registered in accommodations from the city in 2009 increased from 2001 with 11% but declined with 20% from 2008.

In 2001-2009 stands the big increase of overnights number registered in urban and rural pensions.

**The decision of accommodation in 2001-2009**

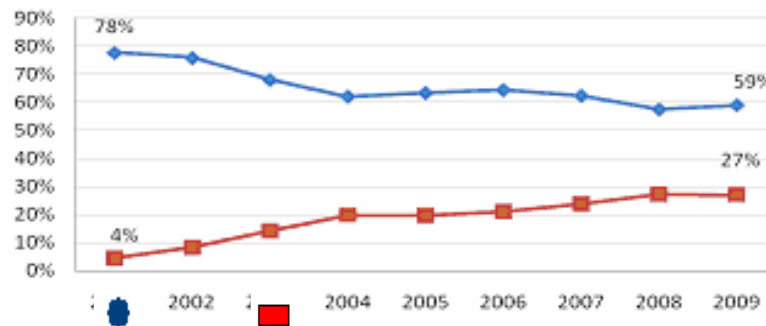


Fig. 5. The Share of Overnights

In 2001-2009, the first option of tourists from the city regarding the decision of accommodation was to overnight in hotel units but closely related to the services offer and features offered by pensions, it increased a lot the number of overnights in this type of accommodation units

(from 38 701 overnights in 2001 to 265747 overnights in 2009).

According to the information offered by County Statistics Braşov, the accommodation capacity (number of places) in specialized units from Braşov increase in interval 2003-2009.

The increase is determined especially by the development of accommodation capacities of available places in pensions (both urban and rural) and in hotels.

Table 3

*Evolution of accommodation capacity - available seats in the main structures*

	2003	2004	2005	2006	2007	2008	2009
<b>Total number of places</b>	13 307	16 375	17 588	20 354	18 987	22 740	22 013
<b>From which</b>							
<b>Hotels</b>	4 369	4 645	4 672	5 505	5 449	5 740	6 128
<b>Pensions</b>	2 316	3 297	4 072	4 665	4 884	5 440	5 768
<b>Tourists villas and chalets</b>	1 380	1 698	1 479	1 806	1 469	1 571	1 517

The total number of available accommodation places increased in 2003 by 40%. Accommodation offer diversified, and in 2009 in rural areas there were over 19% of the total capacity of the city.

In 2009, in Brasov county, the number of available places decreased by 3% from 2008. Net

use index of tourist accommodation capacity in operation (calculated as the ratio between number of overnights realized and tourist capacity in operation) registered large declines from 2008. If in 2008 almost a quarter of the number of available rooms was occupied, in 2009 or 20% of capacity was not occupied.

Table 4

*Index of use of tourist accommodation capacity in operation (%)*

	2003	2004	2005	2006	2007	2008	2009
<b>Accommodation units-total</b>	22.6	24.6	23.7	23.3	25.3	26.1	19.6
<b>Hotels</b>	32.9	34.8	36.1	33.8	36.0	34.7	26.0
<b>Inns and motels</b>	40.2	38.4	30.3	25.0	27.0	29.3	20.8
<b>Villas</b>	27.4	24.6	21.4	17.3	18.3	25.0	25.0
<b>Chalets</b>	9.0	9.8	11.6	13.7	12.9	15.5	11.4
<b>Urban tourist pensions</b>	26.3	21.2	16.0	16.9	20.1	21.4	15.0
<b>Rural tourist pensions</b>	12.2	14.9	10.7	9.7	11.9	15.0	11.1
<b>Camping</b>	5.9	13.6	0.9	-	-	21.0	25.8
<b>Camps and preschool student</b>	4.7	5.0	11.2	9.5	32.2	5.4	17.0

Based on actual and proposed accommodation possibilities, it can say that there is an adequate accommodation capacity. Actually, judging by occupancy rate, there is an oversupply of rooms leading to lower profits and inadequate capital for the modernization.

At county level, the index of use of accommodation capacity peaked in 2008, from 22.6% to 26.1%, but even in these conditions utilization is estimated at a quarter of total capacity.

#### **4. The analysis of the possible advantages of a voluntary chain in Brasov area, having like model Inter Hotel chain from France**

Analyzing the statistics regarding the tourism situation from Brasov, it is considered that the implementation of a voluntary chain would be useful for pensions, because these would need notoriety. Although the pensions (both from urban and rural area) have a percentage of 72% from accommodation units, the overnight share is larger at hotels-59% than 27% for pensions, in 2009. The difference between available places in hotels and pensions is small (6 128 in hotels, 5768 in pensions), but the tourists choose to overnight in hotels.

Hotels have index of use of accommodation places over average capacity of other accommodation registered at the county level.

Index of use of accommodation capacity before 1990 was almost 60%, now, it declined to half of it. For its increase it is required a series of measures, such as: diversification of tourist packages, offers or even the implementation of a marketing strategy concerning Braşov tourism.

In this way the implementation of a voluntary chain may involve:

- choosing name, logo and management team;
- joint promotion: common website, brochures and leaflets;
- computerized reservation system;
- contracts with agreed suppliers;
- establishing quality criteria for all pensions from the chain;
- common specialized services.

The advantages of a voluntary chain in this area may be the following:

- promoting the area;
- attract a greater number of tourists;
- increased confidence in pensions services;
- the possibility of developing less known pensions;

- decrease supply costs by contracting agreed suppliers;
- obtain financing on favorable terms;
- tourists have the opportunity to make a reservation at a pension from the chain for another;
- increasing the use of accommodation capacity.

## 5. Conclusions

In conclusion, Romania could develop both tourism and overall economy if people involved in the tourism industry would use new concepts for Romanians with ancient tradition for others, as the concept of voluntary chain in France, and which, as analyzed earlier, would have a real impact in Romania, in Braşov area.

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## TRENDS CONCERNING THE EVOLUTION OF INTERNATIONAL TOURISM

C.E. ENACHE A.M. FEDOREANU

**Abstract:** International tourism recovered powerfully in 2010 from the depression it suffered due to the global financial crisis and economic recession. International tourist arrivals reached 935 million and increased by almost 7%, based on the exceptional 4% decline in 2009. Nevertheless, the multi-speed recovery was primarily driven by emerging economies.

Tourism 2020 Vision projects that international tourists are expected to reach nearly 1.6 billion by the year 2020. The total tourist arrivals by region shows that, by 2020, the top three receiving regions will be Europe (717 million tourists), East Asia (397 million) and the Americas (282 million), followed by Africa, the Middle East and South Asia.

**Keywords:** tourism barometer, multi-speed recovery, tourism receipts and expenditure, tourism growth, tourism 2020 vision, tourism trends.

### 1. The evolution of tourism in 2010

International tourism has recovered faster than expected after the impact of the financial crisis and economic recession in 2008 and 2009, boosted by increased confidence and improved economic conditions. Worldwide, it is estimated that international tourist arrivals reached 955 million, 58 million (+6.7%) more compared with 2009 and 22 million (+2.4%) over the pre-crisis peak year 2008 (913 million).

#### 1.1. Inbound tourism trends

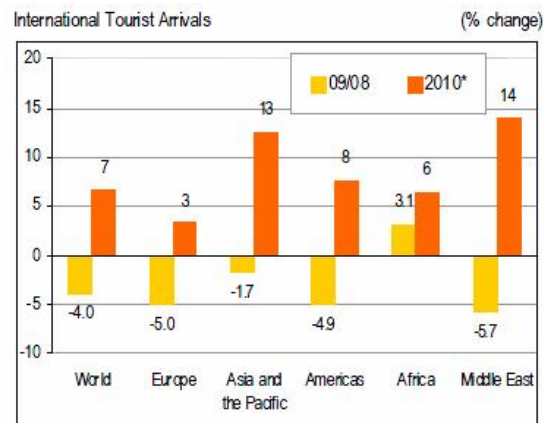
International tourist arrivals are growing in all world regions.

At this point, over 150 countries, representing two thirds of the total number and including all major destinations, have reported data on international tourist arrivals for 3 to 12 months for the year 2010. Of those, 27 still have negative numbers (18%), while 126 show positive figures (82%). Based on this sample of destinations, arrivals growth worldwide for 2010 is estimated at 6.7%.

Emerging economies rebounded faster than advanced economies and led the recovery, with an average growth of 8% compared with 5% for advanced economies.

Regarding the economic situation, the tourism sector is now facing growth rates at different speeds.

Africa, the only region that showed positive figures in 2009, due to the FIFA World Cup, maintained growth during 2010 with a rate of 6% reaching a total of 49 million arrivals.



Source: World Tourism Organization (UNWTO) ©

Asia and the Pacific, the first region that recovered, recorded a remarkable increase of 13% in 2010, following a modest decline of only 2% in 2009, making it the fastest growing region over the last two years. Arrivals in this area have reached a new record of 204 million, providing a market share of 22%.

The Middle East was the region with the strongest growth in 2010 (+14%), following a significant decline in 2009. The region

recorded 60 million arrivals, favored by intraregional travel and high oil prices.

The Americas (+8%) recovered from the decline in 2009 and reached a new record due to the signs of recovery of the U.S. economy and the growth of regional integration in Central and South America.

In Europe (+3%) the recovery was slow, because it was the most affected region. However, tourism has gained momentum in the second half of 2010 and some countries (e.g. Germany 12% and Turkey 6%) have performed well above the regional average.

### 1.2. The recovery of international tourism

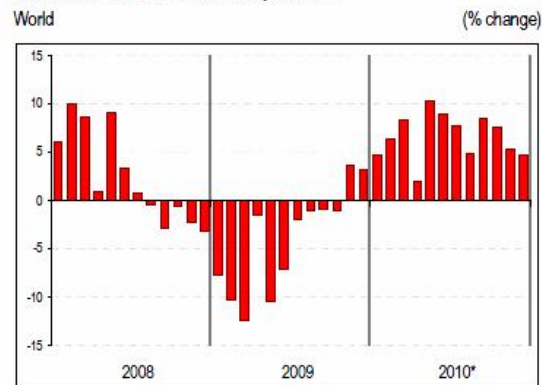
Tourism gained momentum in June, when the monthly arrivals of tourists began to reach record levels consistently exceeding those of the same month in previous years. Uncertainty dominated the first half of 2010, with high growth rates only because they were reported to the low base of 2009, and a disappointing slowdown in April (2%), when the ash clouds after the eruption of a volcano in Iceland have caused the closure of European airspace.

In the second half of the year the growth rate was expected to slow, because the figures from the same period of 2009 were no longer so depressed. However, the growth remained stronger than anticipated, especially in September and October. This could be explained on the one hand by the revitalization of business tourism and, on the other hand, by supplementary leisure trips outside the typical season. Few countries have yet reported data for December, but tourism is expected to have been affected due to the bad weather in North America and Europe.

Looking back at the impact, that the financial crisis and economic recession have had on tourism, a month-by-month analysis shows an almost perfect V-shape of fifteen consecutive months of negative growth rates, from August 2008 to October 2009, with the largest decline in March 2009 (-12%). This is followed by a rebound as a mirror image of

high growth rates compared with a very low base.

International Tourist Arrivals, monthly evolution



Source: World Tourism Organization (UNWTO) ©

For most regions, the form of decrease was similar, but with considerable variation in depth and length. In Europe the period with negative growth lasted nineteen months consecutive, from July 2008 to January 2010, with a minimum of -16% in March 2009. In Asia and the Pacific the crisis lasted just twelve months from August 2008 to July 2009, with a minimum of -11% in February 2009. The Americas have experienced thirteen consecutive months of negative growth, from September 2008 to September 2009, with a minimum of -13% in March 2009. In the Middle East and Africa the pattern was a little irregular. The Middle East took a sharp but brief decline from January 2009 to May 2009, and Africa had some negative months, but overall had no real loss.

Sub-regional results clearly reflect this multi-speed recovery. The growth rate shows the existence of four different modes of recovery, from continuous growth in destinations that have taken power in crisis, to total or partial recovery of destinations that scored slightly above or below the previous peaks till destinations that are still under the influence of the crisis.

### 1.3. International tourism receipts and expenditure

For most countries, data on international tourism receipts and expenditure are far from being completed in this time of year, and still tend to be temporary, often needed to be



revised substantially. In addition, for a comprehensive analysis, exchange rates and inflation also need to be taken into account. A complete analysis of these indicators can be provided only in April, when data from the fourth quarter will be issued by most countries. But preliminary results seem to confirm two trends:

- International tourism receipts growth has fallen behind the growth in arrivals, as is characteristic of recovery periods. Following major shocks, the volume of arrivals tend to recover faster than earnings (receipts), because the competition is fierce and suppliers try hard to keep prices, and tourists tend to travel closer to home, for shorter periods of time, and on a low budget. Of the fifty largest destinations, thirty-five have reported positive growth (74%) and twelve declines (26%) in terms of international tourism receipts.

- Emerging economies also lead the recovery in terms of increased costs (expenditure) abroad. In the top outbound tourism markets, in terms of expenditure abroad, emerging economies stand out: China (+17%), Russian Federation (+26%), Saudi Arabia (+28%) and Brazil (+52%). Of the traditional source markets have recovered: Australia (+9%), Canada (+8%), Japan (+7%) and France (+4%), while a more modest increase (+2%) came from the USA, Germany and Italy. United Kingdom registered a further 4% decrease.

#### **1.4. Air transport**

Air transport is still most preferred by the tourists (53%), followed by road transport (39%), sea (5%) and rail (3%).

Preliminary data on air transport published by the International Civil Aviation confirms the full recovery of international traffic demand, with total scheduled of passenger traffic increasing by approximately 8% per year.

The recovery was led by international traffic (+9%) due to the strong recovery of leisure and business long-haul travel, especially from emerging markets.

The general trend is confirmed by statistics published by Airports Council International, which reported an increase of almost 8% in international traffic and 6% for domestic passengers till November 2010.

#### **1.5. Predictions for 2011**

Growth is expected to continue in 2011, but at a slower rate. UNWTO predicts a growth rate of 4% to 5%, slightly above the long-term average of 4%.

Emerging destinations, particularly Asia and the Pacific and the Middle East are expected to continue leading the growth, taking advantage of an exhausted demand from the neighboring countries. In advanced economies, the major challenges to forecasted growth are related to the economic outlook, including high unemployment and low consumer confidence.

Forecasts of 2011 expressed by the UNWTO's Panel of Experts are optimistic overall, with high expectations in Asia and the Pacific and in the Americas.

#### **1.6. Preliminary conclusions**

In our opinion, international tourism has shown vulnerability to short-term shocks in 2009, a year ruled by economic uncertainty, natural disasters, political and social movements that led to the decrease of international tourist arrivals by 4% compared to the pre-crisis year 2008. However, international tourism demand remained good in 2010. Thus, global growth rate in 2010 is actually the mirror image of 2009. Given this fact, we consider tourism an elastic sector in economic terms, because the tourism demand is directly influenced by lower incomes.

We believe that the economic recession has highlighted the need for cooperation among all stakeholders to ensure competitiveness and respond more effectively to challenges.

Major events have helped to balance the negative effects of economic crisis, with an extraordinary ability to attract visitors and positioning the host country in the top of

attractive tourist destinations such as South Africa (FIFA World Cup), Shanghai (Expo 2010), India (Commonwealth Games) and Canada (Winter Olympic Games).

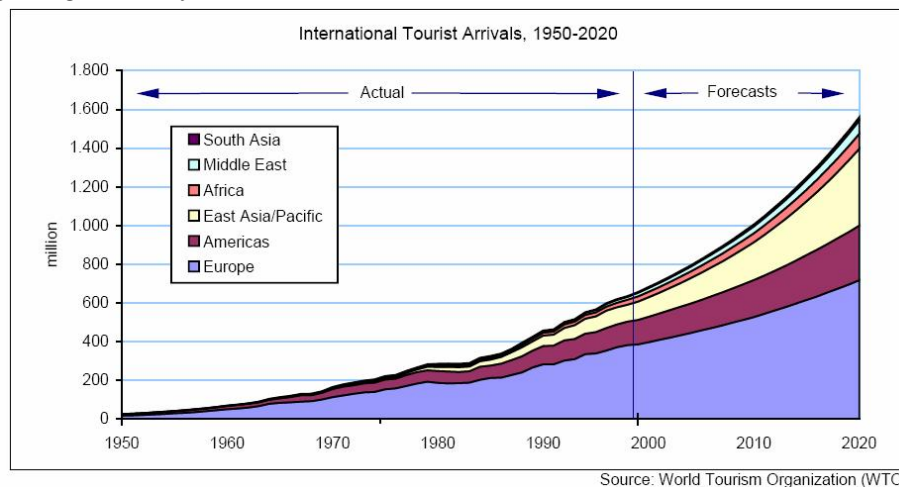
## 2. Tourism 2020 vision

Tourism 2020 Vision is a long-term forecast and evaluation of tourism development up to the first 20 years of the third millennium, developed by the World Tourism Organization (UNWTO).

A key result is the quantitative forecasts covering a period of 25 years, with 1995 as base year and forecasts for 2010 and 2020. Although the evolution of tourism over the recent years has been irregular, UNWTO maintains its long-term forecast for the time. The basic structure of the forecast trends has not changed significantly.

UNWTO's Tourism 2020 Vision forecasts that international tourist arrivals are expected to reach about 1.6 billion by 2020, of which 1.2 billion will be intraregional and 378 million will be long-haul travels.

The total tourist arrivals by region shows that by 2020, the top three receiving regions will be Europe, East Asia and Pacific and the Americas, followed by Africa, the Middle East and South Asia. East Asia and Pacific, Asia, the Middle East and Africa are forecasted to record growth rates over 5% per year, compared to global average of 4.1%. The more mature regions Europe and Americas are anticipated to record growth rates lower than the global average. Europe will maintain the highest percentage of international arrivals, although there will be a decline from 60% in 1995 to 46% in 2020.



### 2.1. Africa

Africa consistently exceeded the world as a whole in terms of growth rate in international tourist arrivals, increasing its share from 1.5% in 1970 to 3.9% in 1998. Total arrivals in Africa reached 24.9 million in 1998, more than three times the level recorded in 1980.

The forecasts for international tourist arrivals in Africa indicate that there will be 77.3 million arrivals in 2020. This represents an annual growth rate of 5.5% during 1995-2020, which is above the global growth rate of 4.1%. Consequently, the overall share of

arrivals to Africa is expected to increase over the forecast period to 5% in 2020.

### 2.2. Americas

Despite achieving a near doubling in tourist arrivals between 1980 and 1998, the Americas have slowly lost their share of global arrivals from 21.5% to 18.8% during this period. Total arrivals in the Americas came to 119.9 million in 1998. The North America sub-region underestimated the regional average growth during 1990-1998.

The forecasts for international tourist arrivals in the Americas show that there will

be 282.3 million arrivals in 2020. This represents an annual growth rate of 3.9% during 1995-2020, slightly below the world average of 4.1%. Consequently, the overall share of arrivals in the Americas is expected to fall to 18.1% by 2020, yielding its second place to East Asia and the Pacific.

The tourism 2020 vision predicts that there will be 232 million outbound tourists arrivals generated from the Americas region in 2020. This represents an annual growth rate of 3.1% over the period 1995-2020, one percentage point below the global average of 4.1%. This is the lowest outbound growth rate of all regions with the result that the Americas region will lose market share of outbound tourists from 19.1% 1995 to 14.9% in 2020.

### **2.3. East Asia and the Pacific**

East Asia and the Pacific region was the destination that registered the fastest growth over the past 30 years, due to the gradually developed tourism products and improved international access, the region has improved and costs have reduced. Tourist arrivals have quadrupled between 1980-1998, with a growth rate averaging 8.1% per year.

Forecasts for international tourist arrivals to East Asia and the Pacific show that there will be 397 million arrivals in 2020. This represents an annual growth rate of 6.5%. Consequently, the overall share of arrivals in East Asia and Pacific is expected to increase during the forecast from 14.4% in 1995 to 25.4% in 2020. All subregions will grow at rates between 6.2% per year (Australia) and 6.7% per year (Northeast Asia) between 1995 and 2020, and therefore will gain market share in arrivals worldwide.

Tourism forecasts for outbound tourism arrivals from East Asia and Pacific show that China will expand the fastest at 12.3% per year between 1995 to 2020 and will reach 100 million arrivals, but Japan remains the largest generator of tourists, meaning 141 , 5 million international arrivals in 2020, with a growth rate of 7.5% per year during 1995-2020.

### **2.4. Europe**

Europe has been the world leader in terms of tourist arrival for a very long time, but due to the increasing number of new destinations from other regions, its world share has fallen by five percentage points over the period 1980 to 1998. Even though its annual growth rate is smaller than the world average over the same period of time, Europe has a strong increase in arrivals, that doubled since 1980.

The forecasts for arrivals in Europe indicates that there will be 717 million arrivals in 2020. This represents an annual growth rate of 3.1% during 1995-2020, which is one percentage point below the world rate of growth of 4.1%. Consequently, the overall share of arrivals in the European region is expected to decrease over the projection period. The growth rate of arrivals in Western Europe will be the lowest of all the European sub-regions, and by 2020, Central / Eastern Europe will attract more visitors than Western Europe. A significant increase is also expected to arrivals from Eastern Mediterranean subregion.

It is expected that over 729 million outbound tourists will be generated from Europe in 2020. This means an annual growth rate of 3.4% during 1995-2020, more than half a percentage point below the global average of 4.1%. While Europe remains the largest tourist generating region in the world, it is losing its market share. 55% of outbound tourists were from Europe in 1995. By 2020, this percentage will decrease up to 47%.

### **2.5. Middle East**

Besides 1980, the Middle East arrivals grew faster than arrivals recorded worldwide in the last quarter century. Consequently, the share of arrivals to the region increased from 1.6% in 1975 to 2.4% in 1998. Total arrivals in the Middle East reached 15.3 million in 1998, nearly four times the 1975 level.

The forecasts for international tourist arrivals to the Middle East indicate that there will be 68.5 million arrivals in 2020. This

represents an annual growth rate of 7.1% over the period 1995-2020, which is above the global growth rate of 4.1%. Consequently the overall share of arrivals in the Middle East region is expected to increase during the forecast period.

It is expected that over 35 million outbound tourist arrivals will be generated from the Middle East region in the year 2020. This results in an annual growth rate of 5.8% during the period 1995-2020, over one-and-a-half percentage points above the global average of 4.1%. While the Middle East will remain the world's smallest tourist generating region, it will increase its worldwide market share. In 1995, 1.5% of all outbound tourists were from the Middle East. By 2020, this will increase to 2.2%.

## 2.6. South Asia

Although still the smallest tourism region of the World Travel Tourism, South Asia has been recording steadily increasing growth over the past four decades due to the large number of new destinations offered in the region and the expansion of tourism product developed in major countries in the region. These developments have served mainly to long-haul interregional tourism. The share of international tourist arrivals to South Asia increased two and half times over 1960, from 0.3% to 0.8% currently, although the 1980s were a lean period when South Asia's share decreased from 0.8% in 1980 to under 0.7% in 1990. However, the 1990s have seen strong growth in the region, exceeding the global growth of arrivals in each successive year except 1993.

Forecasts for international tourist arrivals to South Asia show that there will be 19 million arrivals in the year 2020. This represents an annual growth rate of 6.2%. Consequently the overall share of arrivals in South Asia is expected to increase during the forecast from 0.7% in 1995 to 1.2% in 2020.

The study forecasts that there will be about 17 million outbound tourist arrivals generated from South Asia in 2020. This means an annual growth rate of 5.6% during

1995-2020, one-and-a-half percentage points above the global average of 4.1%.

## 2.7. Preliminary Conclusions

We believe that Europe will maintain its place at the front of the international tourist arrival top 10 years from now, followed by East Asia and Pacific and America. In terms of market share, however, Europe will register a decrease by fifteen percent over the share in 1995. In comparison, its main competitor, East Asia and Pacific, will register an eleven percent growth in market share in relation to the same year.

The average annual growth rate in Europe will be the smallest, while East Asia and Pacific will record a growth rate almost double that of Europe. Africa, Middle East and South Asia will also register increases in the tourism market share with above average global growth rates. As Europe, America will decrease in market share too, but only by one percent, with a growth rate below the overall, but higher than that of Europe.

The leader destination, who will register the most foreign tourists arrivals, will be China with 130 million, meaning 8.3% of the tourism market, followed by France with 106 million and 6.8% of the market, but with a half past five percentage point lower growth rate compared to China. The Russian Federation will be the second smallest, with 48 million tourists, but with a higher growth rate than China.

The first country in the outbound tourism top is Germany with 153 million tourists emitted, almost one tenth of the tourism market, followed by Japan with 142 million, U.S. with 123 million and China with 100 million. Canada and the Russian Federation will be equal with 31 million tourists and 2% market share each.

## 3. The Master Plan for National Tourism Development 2007-2026

The Master Plan for National Tourism Development was designed by the World

Tourism Organization's experts with their counterparts in Romania.

The major objective is to identify weaknesses in the Romanian tourism industry, to draw strategic directions in restructuring and the resources needed for this purpose and to regenerate tourism in order to compete effectively in the global market.

The main specific objectives are:

- To create the country's brand;
- To ensure a sustainable tourism development;
- To develop and to implement marketing plans;
- To develop public-private partnerships;
- To create a network of tourist information centers;
- To establish the Romanian Tourism Satellite Count;
- To extend the travel page;
- To develop an efficient classifying and evaluating system;
- To conceive mechanisms and subsidies to facilitate tourism investment;
- To strengthen the legal framework in tourism;
- To develop health resorts;
- To develop mountain resorts;
- To develop ecotourism;
- To extend the national transport infrastructure;
- To extend the sightseeing marking;
- To create a central database in the tourism industry field;
- To develop an effective strategy to implement the Master Plan.

The Master Plan also provides the implementation of three programs designed to bring the Romanian tourism at a competitive European level: "Romwelcome" (Awareness Program in Hospitality and Tourism Sector), "Romservice" (Hospitality and Tourism Services Improvement Program), "Romskills" (Restructuring Professional and Institutionalized Training

The Implementation Group should have been formed of: Secretary of State for Tourism - President, ten members representing ministries, regional and local

authorities and the main areas of private sector and the General Director for Development of The National Tourism Organization. This group was never formed.

Of all the targets that have been mentioned only three were achieved: the country's tourism brand, extending the travel page and the marking system of national objectives.

#### 4. Conclusions

We appreciate that trends of the international tourism development in the medium and long term will not be significantly affected by economic recession.

Experience shows that short periods of rapid growth (1995, 1996, 2000 and from 2004 to 2007) alternate with periods of slow growth (2001, 2002, 2003, 2008 and 2009). We expect the current economic slowdown to be offset in the medium and long term.

Looking at preliminary data of the international tourism barometer, it highlights the following trend: different speeds recovery - faster in emerging economies, slower in the advanced ones.

Other findings are also highlighted:

- Emerging economies lead the recovery in oversea spending growth;
- Receipts growth remains behind the arrivals growth, typical for recovery periods.

Another trend that emerges is the gradual revival of business and leisure travel, mainly by air and road.

Still at a conceptual level, the implementation of The Master Plan for National Tourism Development is not yet considered a national priority by the Ministry of Regional Development and Tourism. Thus, Romanian tourism prospects remain uncertain. For now we do not believe that we can align the upward trend of international tourism.

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# HUNTING TOURISM: CURRENT CHALLENGES FOR FUTURE GENERATIONS IN REPUBLIC OF MOLDOVA

V. GULCA\*

**Abstract:** *This study will briefly outline some of the cultural, historical and institutional challenges for developing of hunting tourism in Republic of Moldova. We also discuss some of the land use issues relating to conversion of farmland into forest land. We then highlight some of the challenges for developing a sustainable hunting tourism based on forest and agricultural lands. The study concludes with a discussion of some of the opportunities that hunting tourism may provide for local people.*

**Keywords:** *wildlife, conservation, deficiency, natural resource, people.*

## 1. INTRODUCTION

Located in the southeastern part of the European continent between Ukraine and Romania, Republic of Moldova (RM) has limited natural resources compared with other developing European countries such as Albania or Bosnia. Agriculture has been the dominant land use over the last few centuries, and poor land practices has led the country with some of the richest soil in the world to now have a greatly diminished economy with few alternatives. This, in turn, jeopardises the security of RM. New alternative land use based on wildlife resources could diversify and greatly improve the economy.

In Sweden for instance it was the development of mining, forest and hydroelectric industries from indigenous raw material that enabled Sweden to become a modern industrial nation. Developing a hunting tourism program for RM based on forest and agricultural lands may provide a similar strategy that could greatly improve the economy of RM. This strategy must encourage farmers to invest money, land and time in commencing commercial wildlife practices aimed at developing an agro-hunting-rural tourism economy. There are numerous cultural, historical and political challenges that need to be overcome in order to develop a viable hunting tourism program in RM. We hypothesised that the land use histories as reflected in ownership pattern affected the sustainable wildlife management. However, the opportunities are equally great as the challenges, and the development of a hunting tourism

program for RM can result in economic independence, security, and social health for future generations.

## 2. Habitat description

Having a hilly character the country is slightly inclined from the northwest to the southeast, and gradually descends from 400 to 150 m altitude. Republic of Moldova (RM) has a temperate-continental climate. The mean annual temperatures vary from +7.8°C N to +9.9°C S and average annual precipitations vary from 486mm S to 617mm N. The depth of snow during winter may vary usually around 0-20 cm. The hydrographical network consists of 3 260 rivers and rivulets with a total length of above 16 000 km. There is a wide range of soils in RM, the most prevalent being chernozems (black earth) covering 75 percent of the country. Of the total area of 3 384 357 ha 57.6% are used as agricultural lands, 9.1% as localities lands, 17.84% as reserve fond occupied by pastures, forest protected belts and roads, 1.8% of lands are destined to industry, transports communications etc., 11.4% to the forest fond, 0.06% land to nature protection, historical-culture value, etc., and 2.2% to water funds [16]. At present, the hunting fund covers a surface area of 2.8 million hectares with the largest part being occupied by open landscape [20]. Hunting lands are considered areas of land, forest and water funds that constitute the habitat for wildlife [23]. Forests comprise 329 000 ha or about 9.7% of the country's territory. Qualitatively, the forests of

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RM consist predominantly of broad-leaved trees (97.8%). The current group structure of stands is mostly unbalanced. The average forest age is 40 years, with young trees representing 26.3%, middle-life trees 43.7%, pre-exploitable trees 17.5%, and exploitable trees 12.5% (Gulca and Herbst, 2005). The situation has worsened because about 800 forest units with a surface from 5 to 1500 ha are distributed differently in agrarian ecosystems (Fig. 1), and wildlife habitats are fragmented by 1680 localities with an average density of 119 inhabitants per km<sup>2</sup>.

### 3. Wildlife evolution

According to Averin et al. (1975) during XVIII-XIX centuries were disappearing from this region European bison, aurochs, Saiga tatarica, tarpan, moose, red deer, bear and lynx. The vestiges of forests harbour at the beginning of the XX century only two species of ungulates: roe deer and wild boar. After the 2nd World War the forest cover decreased to 4% that led the populations of roe deer, wild boar, and marten to the limit of disappearance (Tiscevici and Bordiug, 1973). Together with people restoration, in the beginning of second half of XX century, occurred a slow natural recovery of wildlife when leading factors of natural mortality were wolf predation and disease/starvation.

During the period of 1954-1982 were made ten reintroductions of red deer, four introductions of maral from the Natural Reservation Askania Nova, Ukraine, seven introductions of sika deer and two introductions of fallow deer. An interesting feature of this period was the simultaneity of actions for wildlife restoration and protection (e.g. hunting prohibition or reintroductions of red deer) with actions that led to wildlife (like European mink *Lutrola luterola*, otter *Lutra lutra*, bustard *Otis tarda*) extinction (e.g. bog draining or steppe fallowing on thousands of hectares). During the period 1960-1970 over 20 000 ha of slopes were worked (subsequently these areas were lost as a result of erosion and gliding); also over 80 000 ha of marshes were drained; as a result land utilisation reached at the end of the 80th the limit of 90% (Capcelea, 1996). According to Gania (1968) in the post-war period application of dust DDT (15-20 kg/ha) was made almost over all forest areas of Moldova (209 000 ha) that led to death of many wild vertebrates. Concentration of agricultural production, intensive chemization and irrigation, livestock industrial development

was in permanent need of new land and more fodder. The reduction of wildlife habitats caused extinction of many wild predators and raptors. Moreover, most of the predators and raptors were persecuted as harmful for agriculture, livestock and people. Wolf considered as most dangerous, disappeared in the middle of 80th completely from that territory. Sometimes during winter wolf could migrate for a short time from Romania crossing the frozen Prut River. Unfortunately stray dogs, now counted at more than 10 000 individuals, occupied wolf's niches. A more steady component of predators community is fox, the number of which varies between 25 000 individuals during 1967-1968 period (Uspenskii, 1972) and 15 000 individuals during last five years.

### 4. Carrying capacity

Sustainable wildlife management imposes as a condition to know as accurate as physical potential provided by land for the existence of hunting species. The conditions of any hunting unit to assure food, shelter, and breeding optimal conditions for a certain number of species are named carrying capacity. The term of carrying capacity, introduced in wildlife science by Leopold (1933), became one of the most common phrases in wildlife management. The author of this term and many other wildlife researchers understood by carrying capacity mainly the nutritional capacity as the base factor determining the number of animals in a given habitat. Some of them are referring as well to other factors which affect to a certain degree and often limit the caring capacity for hunting lands. According to (Caughley & Sinclair, 1994), that term covers a variety of meanings and unless we are careful and define the term we may merely cause confusion. These authors understand under ecological carrying capacity the natural limit of a population set by resources in a particular environment; economic carrying capacity is thus the population level that produces the maximum sustained yield for culling or cropping purposes in the context of particular land use requirements. With a goal to establish criteria for carrying capacity in RM we have analysed methods and opinions from different countries (Gulca, 1997). Because from all 2 800 000 ha of hunting grounds only a part are suitable for red deer, roe deer, wild boar and pheasant (Table 1) we estimate minimum and maximum optimal number of hunting animals for these habitats.



Taking in consideration the optimal number of main hunting species at the end of winter and their average annual natural growth we estimated minimum and maximum sustained yield, which could be used partially for hunting tourism.

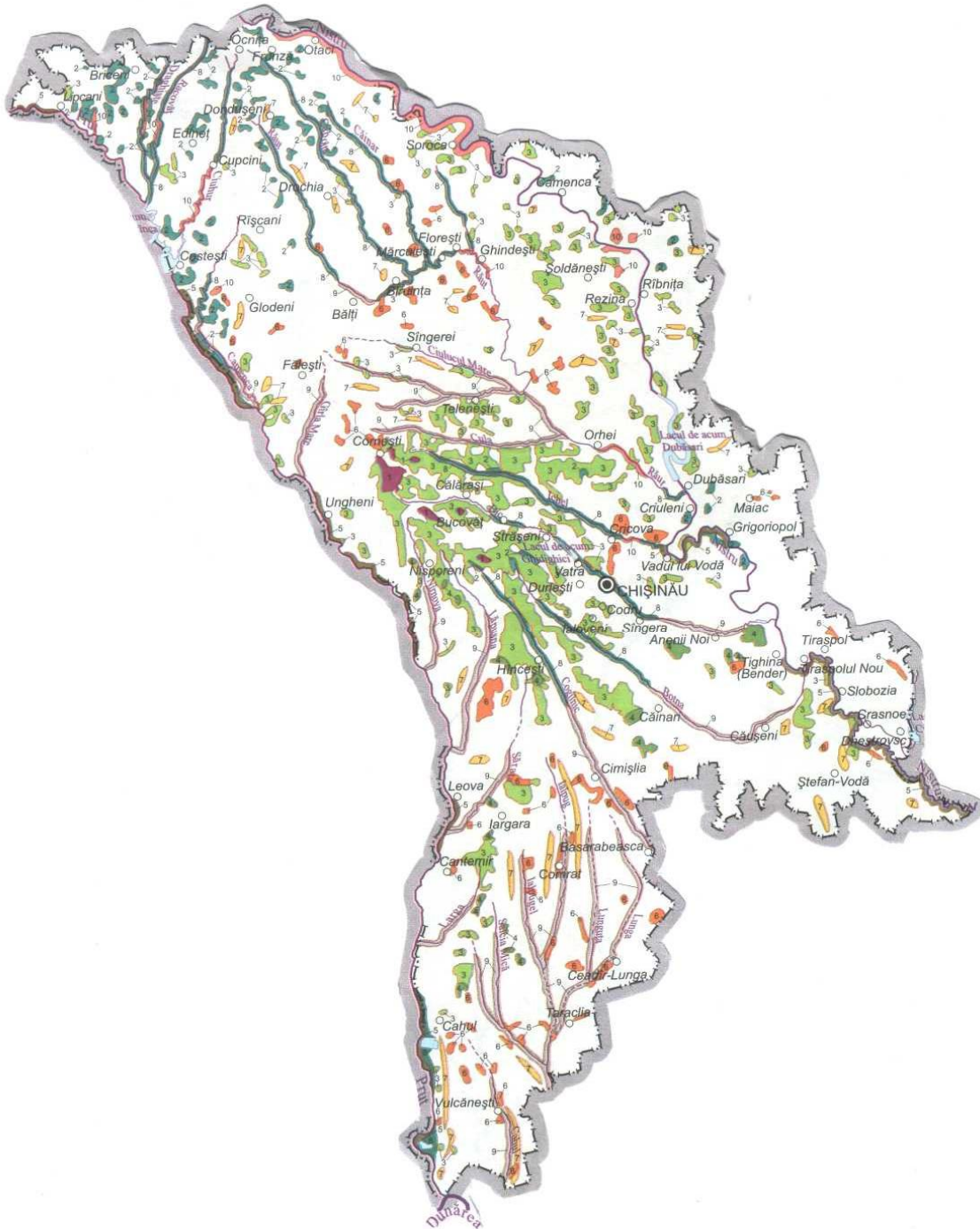


Fig. 1. The vegetation map of Republic of Moldova  
(Source: Atlas of physic and socio-economic geography of Republic of Moldova, 2005)

Table 1. Possibilities of sustained hunting for main game species in Republic of Moldova

Species	Suitable habitat area, ha	Optimal number, individuals				Annual natural growth, %	Sustained yield, individuals		Actual number, individuals
		IV carrying capacity		I carrying capacity			IV carrying capacity	I carrying capacity	
		1000 ha	Total	1000 ha	Total				
Red deer	150000	1	150	20	3000	15	23	450	450
Roe deer	325000	12	3900	60	19500	20	780	3900	3800
Wild boar	325000	4	1300	20	6500	40	520	2600	1750
Hare	2800000	20	56000	100	280000	35	19600	98000	70000
Pheasant	325000	140	45500	700	227500	35	15925	79625	86500

## 5. Management and legislation

In the beginning of XX century concerning to the Game Law (1923), hunting animals belonged to the owner of the land where it was found. In the post-war period wildlife became the domain of the state but with an evident lack of a legislative base necessary for wildlife management. Taking in consideration the critical state of wildlife number, at the end of the 1950ies, were elaborated the legislative and economic bases for wildlife management. In the beginning of 1980ies all hunting lands were in the administration of the Forest Ministry and were divided in three categories: annexed to the state, cooperative and collective organisations; state forestry enterprisers; reservations and prohibited zones for hunting.

On the other side 70% of ploughing lands, high density of human population (108 inhabitants per km<sup>2</sup>), small forest area (8%), draining of marshes, large utilisation in the agricultural economy of poisonous chemicals, poaching etc., (Iacovlev, 1983) diminished all stipulated tasks. Hence with the goal to change the situation, in 1981 was approved the "Law about protection and use of wildlife" which in 1985 was changed by "Fauna Law". Nevertheless game economy was never profitable. Wildlife management was aggravated as a result of the collapse of the former Soviet Union, which had reduced substantially state subventions and protection capacity of authorities. Also the war in the 1992 and spreading of guns to people had promoted poaching both on the level of local people and on the level of chiefs and judges. Taking in consideration this situation the "The regulation on game economy" as annex of the Wildlife Law was approved in 1995. In compliance with item 9 of this regulation, administration of hunting husbandry is performed by the State Forestry Agency "Moldsilva" (SFAM). Also, by Article 11, item (2) of the Forest Code state administration of forest and hunting funds are performed by the Government, local public

administration authorities, state forestry authorities and others.

Hence, there are three principal authorities responsible for management and control of the hunting fund: first, forest authority, which wants to improve the hunting economy but does not have sufficient money to do this work; second, the environment authority, which wants to protect wildlife but without exploitation; and third, local authorities who even nowadays feel game problems through wishing to participate in the privileged hunting as long ago. A fourth actor in the hunting problem not authorised but more active, is the Society of Hunters and Fishers of RM (SHFRM).

The central forest and environment authorities, taking into consideration the critical situation of wildlife ungulates, promoted decision "On the prohibition of sport hunting for hooved animals during the season 1996–1997". Nevertheless the official estimates showed that the number of ungulates remained almost unchanged during the next years. Another attempt to ameliorate the situation was Governmental Decision No. 769 (1997) "On the approval of the provisional regulation regarding the leasing of hunting lands for necessities of the hunting economy in RM". The leasing method of hunting management had the goal to protect and conserve game animals with help of leaseholder's finances. The rent payment was planned to invest in creation of state hunting farms and wildlife restoration, however, in reality these money were spent for other purposes. Conception of development of the national hunting economy (1997) recognised importance to elaborate a Game Law and to divide hunting fund in hunting units with clear natural or artificial limits. These important tasks for development of the hunting tourism have not yet been achieved until nowadays, moreover the "Law concerning the modification and completion of some legislative acts" (2001), approved again game management on open lands by the SHFRM.

As a consequence agricultural lands as part of wildlife habitats are administered by local

authorities and managed by SHFRM while the central forest authority manages the forest fund. But the wildlife does not ask who is manager, and in winter many species prefer the forest while in summer they prefer corn or other fields. In this situation it is impossible to assure efficient wildlife management on 1,000 to 3,000 hectares of forest split into 5 to 30 bodies without taking the surrounding agricultural lands into consideration. Similarly, nothing can be done in agricultural lands during the winter without the food and refuge supported by the forest. The problem is much more complicated, since agricultural lands are divided among a multitude of private owners, who do not accept wildlife damage to their agricultural crops without any compensation. But according to fifth theorem of Leopold (1930), which express the relationship between recreational value, game density, and human density, "only the landholder can practice game management cheaply. He mentioned that the reason is that game management normally consists of many small jobs scattered through the whole gamut of the seasons, and the farmer or the forester can perform these jobs "on the side," often without any separate cash cost.

## 6. Hunting tourism

We believe that hunting tourism has arisen in RM with independence. From the beginning, during the 1991-1998 period hunting for foreigners has been practiced for more than diplomatic, payment of services at the state level or as a sign of gratitude. But hunting tourism is more important for wildlife conservation, to create new jobs, and for developing of hunting sector. During period 1997-2001 were conducted field observations and were identified deficiencies for organising of hunting tourism with three hunting teams from Italy, Cyprus and Netherlands. Deficiencies were grouped into four categories: game resources (separate management of agricultural and forestry lands as habitat for game; unprofitable management of game fund; inefficient control of damages caused to game; weak technical capacity of state structures responsible for game protection; negative anthropogenic factors (poaching, lack of interest from local people); legislative framework (lack of interest from land owners to increase carrying capacity; lack of state financial support; lack game law; inadequate management of game fund; lack of dividing hunting fund in hunting units; lack of efficient mechanism to prevent and

to punish hunting infractions; hunting limits (wrong estimation of game populations; late approval of quotes for hunting; indifference of hunting enterprises with regard to trophy quality; lack of selection to maintain the good sexual and age proportion of the game); services for hunting tourism (weak technical assistance in the field; low capacity for accommodation; bad roads; small game populations; low guarantee to shoot the game; lack of information about quality of trophies).

Further forestry companies were analyzed based on indicators of service capacity: game resources, quotas for trophy game, hunting methods, actual and potential infrastructure, links with intermediary organisations and international hunter companies, regular customers etc. Three categories of hunting tourism capacity were proposed: highest for forest enterprises Tighina, Hancesti, Straseni and scientific reservations "Plaiul Fagului" and "Codrii"; average for forest enterprises Edinet, Chisinau, Telenesti, Razeni, "Manta-V" and scientific reservation "Padurea Domneasca"; and lower for forest enterprises Balti, Glodeni, "Silva-Sud", Calarasi, Nisporeni, Soroca, Orhei, Iargara, Soldanesti, Comrat, Ungheni and scientific reservation "Prutul de jos" (Fig.1).

## 7. Future tasks and problems hunting tourism

Pasturing practice after historical slash and burn farming now has been found to be one of the main factors for shrinking wildlife habitats. For biggest area of RM pasturing is realised without taking into consideration season, state of vegetation and optimal number of livestock per hectare. Subsequent decreasing of pasture quality led to conquering of (20-40%) forests by livestock. This evident retiring of wildlife in favour of domestic animals is motivated in society, by poor pastures, dry climate, deficit of forage, and growing number of livestock. We think that afforestation of public pastures and private agricultural lands could solve the problem with illegal pasturing and logging (Gulca, 2005). We believe that simultaneously that practice will encourage farmers to invest money, land and time in commencing commercial wildlife practices aimed at developing an agro-hunting-rural tourism economy. In this context with a goal to apply some forest management models and practices from other countries to Moldova we

would suggest a combination between patches of up to 0.1 ha on private land as in India, switched focus to farm and community forestry as in Philippines and increasing involvement of the private sector as in China. Of course the direction should be held to Japan, Finland, Sweden and Norway models including proportion between private and public forests (Gulca, 2006). Or, in southern Sweden, the primary idea in the 1930s was to increase the demand for wood and thus increase the value of the forests.

A former company "Ritm contemporan" after leasing in 1997 about 1 000 ha of forests (closed to village Heciul Vechi, Balti county) for hunting reasons, increased the number of wild boars from 20 to 100 individuals during next two years. Because the Ministry of Environment did not approve the quota for shooting before the beginning of the hunting season, the company could not organise hunting tourism properly and later about 50 wild boars were killed by poison, because its extremely high density provoked damages on corn crops in nearby private lands. Alternatively (according to Kline, 2001), if local residents bear the costs of tourism without receiving any benefits, they may be unsupportive of not only tourism but also the conservation of natural areas on which tourism is based. Sustainable tourism development must meet the needs of the host population in terms of improved living standards while satisfying the demands of tourism and protecting the natural environment (Seidl 1994, quoted by Kline, 2001). Thus we should develop restoration goals for wildlife in the light of both historic possibilities and current realities, (Morrison, 2002). In that context we are inclined back to the beginning of XXth century, when concerning to the Game Law (1923), in Romania game belonged to the owner of land where it was found. Or, a point that "plants are part of land while animals are not" shall be stressed between England where (according to Freyfogle and Goble, 2009) wildlife belonged to the landowner (a person had to own land to hunt) and United States, where wildlife belonged to the people and hunting was open to all. The Roosevelt doctrine of conservation according to Leopold (1930), determined the subsequent history of American game management in three basic respects:

1. It recognised all these "outdoor" resources as one integral whole.
2. It recognised their "conservation through wise use" as a public responsibility, and their private ownership as a public trust.

3. It recognised science as a tool for discharging that responsibility.

## 8. Discussion and Conclusions

The recreational and economical values of wildlife on actual territory of RM were mentioned by Dmitrie Cantemir in his work "Descriptio Moldaviae" (1715). According to the Law "Concerning natural resources" (1997), RM profits mostly from soils, forests, waters, wildlife, and mineral solid substance (clay, sand, and limestone). Soil has among them a particular value for the national economy that constitutes a principal natural resource [9]. With 60 percent of hunting grounds in private hands, and 40 percent owned by the public, a great deal of the nation's wildlife lives during the winter on public forest land and during the summer on private agricultural land. Despite of many attempts realised by state and public authorities to restore and conserve wildlife populations, there were not significant changes in game abundance, neither in recreational value during the last 20 years. In that context a major challenge of the project of wildlife law is to establish the legal relationship between the private owner of land and publicly owned wildlife. What rights do landowners themselves have in such wildlife? What legal protections do landowners enjoy when engaged in wildlife-related activities? What can they do when wildlife causes harm? And, finally, what legal issues arise when landowners allow outsiders to hunt on their lands?

National forests have an increasingly significant impact on tourism in communities located near them. Such increasing demand will place growing pressure on public forests to provide the types of ecosystem services desired by many forest visitors. These changes will lead to increasingly difficult decisions concerning national forest management because managers try to balance multifunctional objectives. Already one of the main direction in hunting management during last ten years to create in every forest district (medium 4000 ha) one fenced area (2-4 ha) to increase the number of wild boars was criticised and abandoned in many places. The role the forest authority intends to play in hunting tourism development is not clearly defined. Should the forest agency be more actively involved in hunting tourism development planning or in wildlife conservation? In which forests shall forest agency encourage and in which forests shall discourage hunting tourism? How would the role of forest authority differ depending on carrying capacity, forest district, and relations with villages? The new wildlife law have to answer for these questions if society thinks about next generations.

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## CABLE CARS: ROLE, COMPONENTS AND CLASSIFICATION

E. MIHAIL      A.O. ARISANU

**Abstract:** *This paper presents the cable plant types that are used to transport tourists to areas specially equipped for winter sports and reach areas where there may not be access with another means of transport; their role, classification and their component parts.*

**Keywords:** *funicular, cable, cable transport.*

Cable transport facilities are one of the typical parts of infrastructure of tourist activities and are closely linked to tourist facilities from the mountains. At the same time, cable transport plays an important role in developing and promoting the mountain tourism industry, but also to practice winter tourism

Tourist transport is the first manifestation of tourist consumption, being the only component of the structure product that can not be waived. There is a close link between tourism and transport, it is actually an interconditioning. In carrying out the touristic transport are used a variety of vehicles, their choice being determined by several factors such as distance, specific routes, ground movement, the estate of the communication ways, the level of tariffs practiced.

All types of land transport (rail and road), water (river and sea), air transport are considered to be classic. In places where conventional transport is not possible, there were locally introduced, other ways and transport systems, which are called *unconventional* or *special*. The weight of cable vehicles has increased substantially in all shipments.

### Classification

In general, cable transport facilities are classified according to several criteria:

- cable cars - vehicle that consists of a closed cabin with a specific transport capacity (custom for at least 6 persons);

- Gondolas – the vehicle consists of a closed cabin with a transport capacity of 2 or 4 people;

- Chair lifts – to which vehicles have the form of chairs;

- Ski lifts - which skiers move the snow by their tow cable traction by means of special extensible devices;

- Cable sledges - where the sledges are loaded with people are moving through their tow cable traction extensible through special devices;

**Cable car** - bicable car with swinging gait, with usually having a high capacity cabin on each branch. Carrying cables are anchored firmly in the upstream station and stretched to counter the downstream station. Each cable is made from one piece. On line carrier cables stays on pillars of fixed blocks. Pillars are in general made from metal and rarely from concrete. The cable tractor is involved in one of the stations and spread at the opposite station, and rarely used the drive tractor-tension system cable in the same station, the recommendation is that a section of cable between two pillars should not exceed 2000 m, so that not to record a pronounced friction of worn cable on blocks. The cables of which the two cable cars are running sits on pillars at a technological distance, sized in terms of overall installation transport, which is called ecartament.

In stations and on routes the tractor cable is led and supported on wheels and rollers drift into stations mounted in blocks pillars.

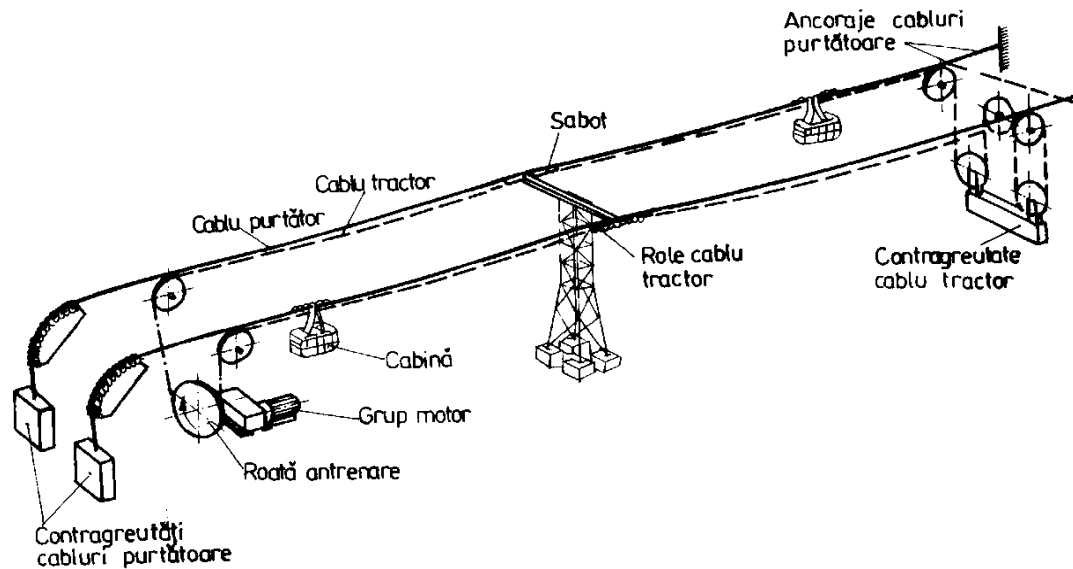


Fig. 1. Cable car

The drive group is equipped with d.c. electric motor that provides the cable car going after a particular program. In all cases there is a group of spare drive powered by an energy source independent of the main engine. Trains roll of cabs are equipped with safety brakes for braking and blocking the carrier cable in the case of towing. If the terrain conditions do not allow lowering the rescue of persons directly to ground, cable cars are equipped with either a rescue facility along its own line (driving group, cable cabin tractor and rescue), or having a motorcar moving along the carrier cable of the locked cabin blocked on the line.

**Rolls:** are the constituent rolls of cable car that are running on wires. Rolls have a locking mechanism, of braking if exceptionally contracable or the cable tractor would roll off the battery.



Fig. 2. Support rollers

**The cabin support:** is the metallic structure of the cabin which ties with special and safe methods and on the adjacent rolls. It is an asymmetric metallic structure of a few meters height to facilitate the transition of cabin of poles, which is determined so as not hit the cable at the sharpest point of the system. It is also provided a metal ladder to facilitate the access of personnel to regular revisions and easy access to items passing cable car or on metal poles.

**Metallic poles:** are of square-shaped space with isolated foundations or, in some cases of two feet of pole, and the foundation may be common. The static structure is that of a lattice beams secured by bracing in x, on all sides to form a rigid structure and compact space to work on uniform and consistent efforts. Usually the pole legs are inclined, calculated so as to take efforts to compression of structure, work side (wind action), elongation and compression efforts to temperature. The slope angle of the pillars of the side pillar legs parallel to the alignment of the plant usually varies between  $18^\circ$  and  $23^\circ$ . Depending on pole position, it may have some rolls to support the drawer cable (minimum 4) or up to 15 rolls (for the big change of slope). The pillar height also varies from 7 m to 113.5 m (Kaprun-Kitzsteinhorn cable car, Salzburg,

Austria.)

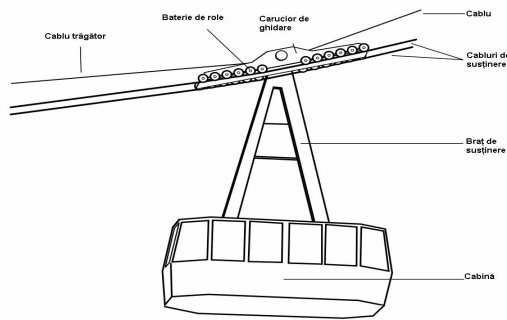


Fig. 3. The component of a cable car scheme

**Cabin:** is from metal and carries passengers. It has different sizes depending on installation requirements. It can vary from a minimum of 6 people to 200 people. The cabin is equipped with a forced evacuation place for blocking it on its route, and passengers are left from that place of the cabin floor in a special bag to the ground. There are cases when relief conditions do not allow the operation mentioned above, and in the station's garage is a cabin for 6 people, and if needed is mounted on a thin wire that is parallel to the carrier and can carry people stuck between pillars in case of forced evacuation. Also, the metal cabin has a phone that can communicate with the head of the facility, a safety brake, and electronic sensors for wind speed warning, in the case the wind exceeds the values set in the sensor. The cabins are also provided with two lights, one in front and another at the other end, for any cases of necessity.

The monitoring system of cable cars have also video camera supervision. This ensures that the responsible personnel can see what is happening in the cabin. Cameras are installed in the ceiling cabins and they are supplied by batteries, solar batteries mounted on cabins, and the images are transmitted over wireless connections to handler

**Gondola:** presents a double feature with easy access both in the high mountains and the ski slopes is a very of great difficulty and length. Cable gondola transport is a facility from the family lifts with unidirectional monocable, the vehicles are in the form of closed cabins - gondolas

Gondola as mean of transport is the most reliable, much less expensive than cable, also at the construction and during operation. They have closed minicabins, usable in all weather conditions, which will increase more efficiency, unlike the lift, which are used only in winter.

Unele sisteme de telegondole pot suporta între 2 și 16 persoane, fiind conectate la cablu prin dispozitive ce permit cabinei să se detașeze de cablu în mișcare și să încetinească la terminal, permițând astfel pasagerilor îmbarcarea și debarcarea

În alte sisteme de transport pe cablu, el este încetinit intermitent pentru a permite pasagerilor să coboare și să se îmbarce în stații pentru a putea, de exemplu să admire peisajele din jur.

Another type of gondola is the bicable gondola, which has a stationary cable, outside the main contribution to support cabin. These lifts are found in Singapore and Canada.

The entrainment and slack in the cable carrier tractor is done with an electric motor and a hydraulic station located below the upper station, and is performed only at the cable return. Along the line, the cable carrier is supported by metal pillars of tubular construction pillars which are equipped with batteries of rollers having rubber-lined channel.

The installation is command and control from the lower station where the control panel and the entire drive system consists of: electric motor, clutch, brake service, gearbox, wheel drive, safety brake, engine spare generator. In plants, vehicles are moving continuously at a speed of 0.3 m / s speed and allow passengers to embark and disembark on go, being driven by an automatic conveyor system. Leaving the boarding area, the doors of gondolas automatically closed, their acceleration take place up to transport speed and coupling to the cable line carrier tractor. On route, gondolas are transported at a speed of 6.00 m / s.

**Lift:** Most lifts are equipped with mobile covers that protect against wind / snow / rain. Canopy can be pulled or pushed back by skiers while using lifts, and if free seats, canopy can be ordered from the front panel to cover the seats automatically, thus protecting them against the snow.

The most important part of the console is the support mechanism linking the seats or the cabins (for both mixed systems) for cable phone. In plants, the seats are running on a track independently by the cable, in these cases the seat is suspended on a rail line, moving the plastic wheels that are attached to the bottom of the locking mechanism on the support bracket, the movement is performed by rubber wheels mounted on the same chain.

Seat heating is becoming more common, the first chairlift with heated seats was inaugurated in



December 2004 in Lech am Arlberg. The operation mode is the following: fire and the elements of heat, through the receiving station, heat, thus ensures good seat while driving. When they reach at the base, the collector of electric current situated above the support console slides on a pair of rails thus loading the current heat elements during the crossing station. The current in the rails and seat is of high intensity but of low voltage, so is not so dangerous to the user in the case of failure.

The advantage of lifts with cabins / removable seats is that depending on weather conditions, cabins / seats can "park" in power stations, are

housed indoors, which makes it easier to work for the maintenance personnel.

**Lift with fixed coupling** - monocable lift with walk-way having a single cable carrier tractor-mounted on closed circuit, which are permanently have vehicles coupled with seats for 1-3 people. The cable runs with slower velocity than the lifts previously described in order to be possible the embarking and disembarking of persons in vehicles while driving. In plants, the vehicles pass on the wheel drive meaning the back wheel, where it needs to secure the clearances pass. The line, and the training group can be almost identical to the other monocable;

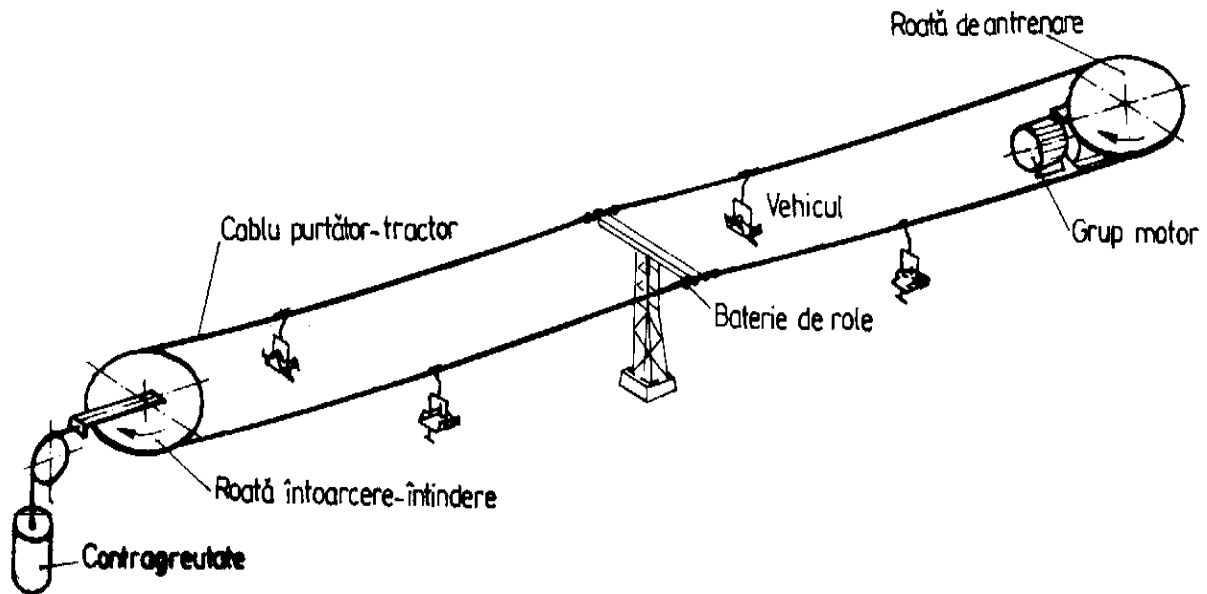


Fig. 4. Lift with fixed coupling

Detachable chairlifts are designed in a 2, 4, 6, or 8 ways with places for large transport capacities up to 4000 persons / hour. They are suitable both touristic seasons, providing optimal solutions for winter sports enthusiasts, passengers being forced to remove their skis during transport. This system provides a solution for loading and unloading in the best conditions of safety, reducing speed to about 0.2 m / s, allowing the the persons with disabilities or children to travel comfortably.

**The ski lift.** The ski lift is an installation of cable transport for people towing skiers on snow

or plastic carpet, is a structure which carries passengers in climbing the mountain so that they can ski downhill.

Ski lifts are classified as:

a) after the nature of towing skiers trail:

- track lift with towing for skiers on snow beaten;
- lifts with towing for skiers on the trail of plastic carpet;
- lifts with traction track called nautic lifts.

b) by the traction type devices (hanging) of cable skiers:

- lifts with fixed clamping devices with cable traction;
- lifts with detachable towing device.

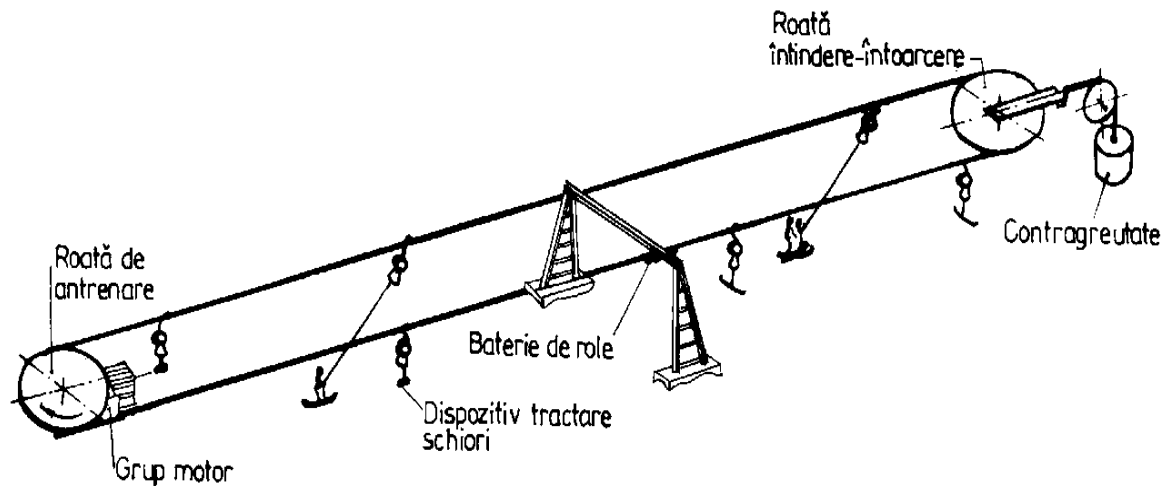


Fig. 5. Lifts with fixed coupling

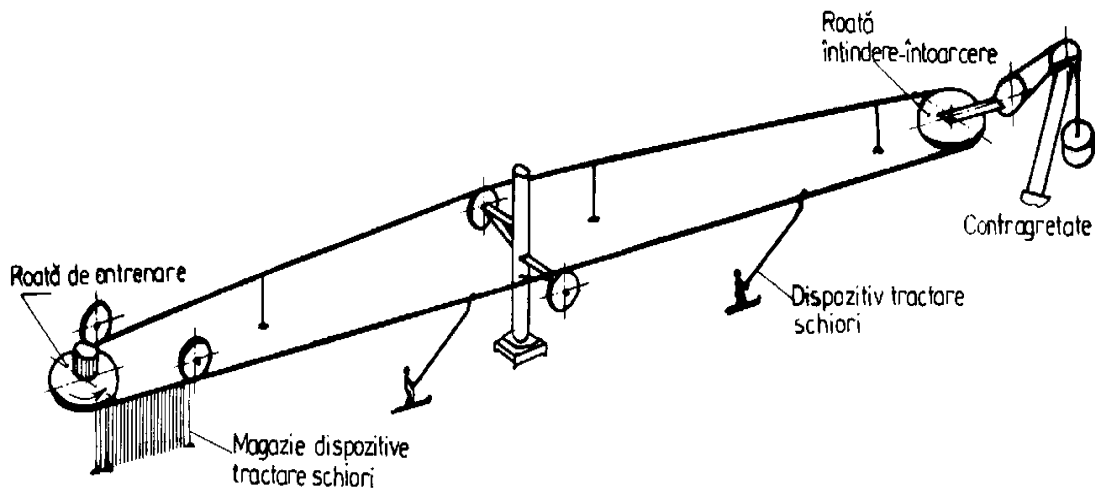


Fig. 6. Lifts with the temporary coupling

c) after the alignment route on vertical position of the cable after installation by the character length of the route and operation place:

- large lifts straight path, equipped with cables located at a height of at least 3.50 m from the track towing skiers, with a slant route length of 300 m and generally being fitted with permanent;
- large lifts route closed as frântă line (slalom) with cables located at a height of at least 3.50 m from the track towing skiers, with a slant route length of 200 m and generally being fitted permanently;
- lifts with only straight path called baby-lifts and cable located at a height of no more than 2.20 m from the track towing skiers, with a

sloping path length at most 400 m and generally being with a temporary character.

d) by order ways:

- lifts with manual control;
- semi-automatic controlled lifts;
- lifts with automatic control.

Lifts movement is influenced by weather conditions, therefore, on each elevator we there are signals for direction and intensity of wind, when the wind intensity reaches critical point, the elevator is stopped due to side oscillations of the lift, and it can not be guarantee safe operation of it.

## Conclusions

The functioning of the entire system is supervised not only by professional staff, but also by road safety assistance in that country, controlling and making periodical inspection of the system. Thus, funiculars are tested in different applications, when they move from upstream to downstream or vice versa maximum number of people carrying at the maximum weight.

The electronic system and handling of the elevator are designed to lead to a great safety, and also be resistant to errors that occurs during operation. Mechanical parts are characteristic of robust design and rigorous testing, this means that the piece that can withstand without damage, a request larger than that for which it was designed, and prototype parts are subjected to rigorous testing before manufacture in series.

For convenience and durability, it is necessary for the elevator to work with minimum resonance. Resonance comes from cable movement on wheels and thereby induces vibrations in the pillars and twisted pair cable.

These vibrations are trying to be reduced by coating the rubber castors, this coating is important to prevent the cable slipping wheels, wheels string being suspended by springs. The resonance is diminished by the fact căgondola or cabin is set on the console with a thick rubber pad. However, resonance can be clearly heard and felt, especially when they pass over wheels pillar of support.

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## THE DESIGN OF THE PROMOTIONAL MIX CASE STUDY – MARONNE RESTAURANT

V. BĂNULESCU    A. BLAJ

***Abstract:** The promotional mix represents the most adequate promoting method used nowadays. Combining it's components - advertising, personal selling, sales promotion, public relations, direct marketing - can be created a successful promoting campaign. In addition to this, the promotional mix is the basic support for the marketers to communicate their message to all the customers.*

***Keywords:** promotional mix, promoting campaign, marketers, customers.*

### 1. Introduction. Promotional mix

The promotional mix is the combination of methods and techniques used in promoting and coordinating activities, in order to achieve marketing objectives proposed in the context of a bigger effectiveness.

The promotional activity refers to a range of communication forms used by economic agents, institutions or individuals in order to inform, persuade and encourage the purchase or consumption process.

The promotional mix tools are:

**1. Advertising**, includes print or broadcast advertising on radio or TV, catalogs, brochures and leaflets, posters, billboards, Internet, audio-visual materials.

Advertising is a non personal communication system, based on payment concerning goods, organizations, places, people, ideas and implies the existence of a message sent through the media by companies, organizations, people who are the promoters that will pay for the message and its dissemination.

**2. Sales promotion** includes games, contests, raffles, lotteries, gifts, fairs, exhibitions and events, demonstrations, coupons, discounts, commissions for selling products, loyalty cards.

**3. Public relations** include press conferences, speeches, seminars, sponsorships, media own magazine company, special events.

The public relation represents a communication system based on the promotion of some good relationships with different types of institutions, organizations, individuals, in order to obtain a more favorable image about the promoted company and to counter its adverse information.

**4. Professional sale** include commercial presentations, meetings, shopping, incentive programs, samples, trade fairs and exhibitions.

**5. Direct marketing** includes catalogs, television sales, e-commerce.

### 2. Case Study – Maronne Restaurant

According to Order No.1296 of 15th April 2010 approving the methodological norms on classification of accommodation: “The restaurant with a certain specific is a catering unit for recreation and entertainment, which, by endowment, profile, employees outfit, recreational moments and assortment structure, should reflect the local or national gastronomic habits, traditional and specific to the different areas.”

“The restaurant with national specific emphasize the national culinary traditions of some nations (Chinese, Arabic, Mexican, etc..), serving a wide variety of meals, alcoholic and non-alcoholic specific drinks. Indoor and outdoor atmosphere of salons, music program, serving staff uniforms and other aspects are distinctive for each country.”

Maronne Restaurant is a restaurant with Italian specific, located in My Place shopping complex, near the Railway Station of Brasov. The restaurant activity fall within the catering area, offering consumers the opportunity to have a meal in a quiet and pleasant atmosphere.

The restaurant target are people aged between 18 and 50 years, with diverse professional activity, focusing primarily on middle and large income segment consumers. The targeted clientele consists of both the Romanian public, particularly those residing in the city of Brasov and foreign tourists eager to taste the menus with specific Italian dishes.

The unit has a maximum capacity of 70 seats and has all facilities required for events, business meetings, proms, receptions or dinners.

## 2.1 SWOT Analysis of the Maronne Restaurant

Making the SWOT analysis is necessary for a correct understanding of the strategic position the restaurant occupies compared to competitors.

**The strengths** of the restaurant are the distinct characteristics and resources which it possesses, which give a competitive advantage.

First, the competitive advantage of the restaurant is the quality of products and the service provided prices and originality.

Secondly, in terms of location, the restaurant is located in an area with heavy traffic: the railway station in Brasov, which is an important railway junction, offering to the restaurant a great rate of success for the clients to choose this place, much higher rate comparing with other location to another gateway of the city. Also, the location may be an advantage in terms of competition, because the restaurant is located in an area with few public food units.

Also, another advantage is the qualification of the local staff, by taking as employee an Italian chef specialist in Italian cuisine and waiters and bartenders with experience, which helps improve the image in front of the customers and impress them with accuracy and elegance in serving the cuisine.

Last but not least, the specific Italian of the restaurant is another important advantage in the market, which helps to be differentiated from the competing units. It is well known that the Romanian people are often attracted to choose Italy as destination of their holiday or as a land of job opportunities and through these affinities, the restaurant can thrive through the simple fact that it brings a bit of what we mean "Italian life" in Romania.

### Weaknesses

The location of the restaurant near the train station Brasov is a weakness because the restaurant does not have access to those tourists, who arrive in Brasov on other access roads in the city.

Another weakness of the restaurant is the narrow segment of consumers which is addressed by the Italian specific promoted.

Positioning the restaurant in the My Place shopping complex creates a significant disadvantage because they lack visibility outside the building and lack the distinctive signs that could capture the attention of passes.

### Opportunities

One of the most important opportunities is the major potential of the Maronne Restaurant

development in terms of specificity, given that at present the competition is low.

The extent in recent years of catering services in Romania is an opportunity for the analyzed restaurant. Because of the staff specialized in Italian dishes, the restaurant is being able to diversify the business, making home deliveries, menus for various events, as well as catering for the accommodation and tourist locations in the city.

### Threats

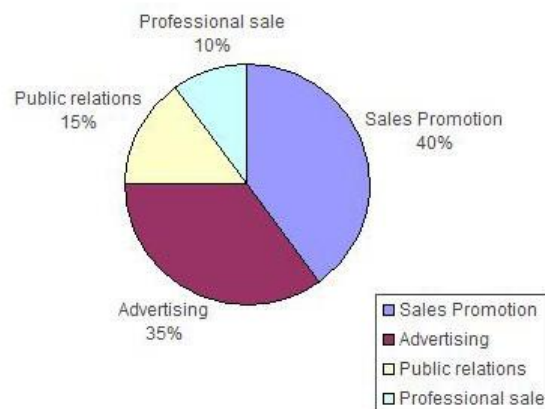
A constant threat is the fast food restaurant sites that are on the same floor with the restaurant, especially a local Chinese, which could influence consumers' decisions.

Another threat on the market, due to the novelty, is the lack of partnerships with specialized sites for promotional offers that benefit most competing restaurants with a high reputation.

## 3. The promotional mix of Maronne Restaurant

The promotional mix of restaurant Maronne (Fig. 1) consists of four elements, each having a certain percentage depending on the importance given to the promotion: sales promotion, advertising, public relations and professional sales.

Fig.1: The promotional mix of Maronne



Restaurant

In order to increase the awareness about restaurant, in a relatively short time, the marketing campaign will have as main pillar sales promotion, being granted a rate of 40% of the promotional mix created, which means almost half the entire promotion campaign.

This tool of the promotional mix is the best for Marrone Restaurant because it presents multiple advantages: provides incentives to encourage customers to try and consume products of the restaurant, shows an increased interest for the buyer because of the products promoted in this way, develops customer confidence through the experience provided and at the moment it gains an increasing popularity among consumers.

In this sense, the virtual field it will be a trial in creating an application or a game about the kitchen, restaurant, bar, in order to be promoted on social networks and provide free meals at the restaurant, every week for the first three finishers in the top, for a certain game. In case such an application will be launched, this will ensure a steady stream of local customers.

In the same time, for those in possession of smart phones, it can be used a special application for them, "Foursquare". The restaurant must have a reduction of 10-20% for users of this application.

The clients, who visit the restaurant and use the application, will make the restaurant to be better known locally through social networking websites. For example, a customer writes a message during his lunch time: "I am at Marrone Restaurant and serve lunch with one ticket meal" or "I am with my girlfriend at Marrone Restaurant. Here you will find the hottest Italian specialties." The messages that are launched automatically will be posted on Facebook or on personal blog account and all the friends of clients will see the posts list. The waiter will be announced that Foursquare application was used and he will offer the established restaurant discounts.

A simple calculation shows that if twenty customers come in the restaurant and use the Foursquare application and those people have in their friends list at least 200 people, the messages reach 4,000 people. In this case, the restaurant is not expensive and not investing almost nothing. A person may spend a maximum 40-50 Ron, so the 10% discount is 5 lei and 20% reduction is 10 lei.

In the same time, also in a virtual environment, a trend would be the use of discount coupons. Such contracts with sites like Kuponiada, Fundeal, Groupon, Profitam etc.. will definitely attract any type of customers, and it will raise the awareness of the restaurant.

There are many other applicable old ideas of professional sales offers such as "happy-hour" for a set time frame, when some meals will have

discounts. Very popular and well received by consumers is also the Fidelity Award Cards. This card may be granted after a constant use and will offer discounts to the customer.

Even if on short-term the profit of the restaurant will not be great, these professional selling techniques, frequently used, have the advantage that often increase the awareness of the location, award the consumers and gain new ones constantly. Another important tool is the promotion advertising, which received 35% of the total promotional mix.

One of the main media agents in promoting the restaurant will be through radio and daily press. The advertisement will be promoted both at local radio stations like "Radio Braşov" and the national stations like "Radio Zu", "Kiss FM" or "Pro FM", the costs of such spot being not very high. As local publications, in order to promote the Marrone Restaurant, it will be possible to refer to the following publications: "Bună ziua Braşov", "Transilvania Express" and also some of the regular publications such: "Zile şi Nopti", „BV 24 Fun " and " Şapte Seri ".

Also, the restaurant will intensively use the virtual publicity because Internet Advertising is the cheapest way to promote, that has become the main tool of mass communication.

Thus, the restaurant will create their own site, such as [www.marrone.ro](http://www.marrone.ro), where it can be related the specification of restaurant and kitchen, and offers that will help potential customers to be aware of what's new in local.

Given that the customer target is middle-large income, this site will have an application for smart phones, so it can be used by individuals possessing advanced gadgets. Advertising campaign will go on in virtual field, because the purpose is that this place to be promoted both through websites for the city of Brasov, and using social networking sites such as Facebook, Netlog, Twitter, Personal Blog etc., which only requires time, money costs are nonexistent.

As outdoor advertising the restaurant will have printings such as brochures and advertising leaflets. Those can be a real advantage in increasing sales and promoting the restaurant. It will include information on cuisine, the relevant prices, location, presentation delivery service at home and possibly a map, and will be distributed in shopping centers, in various national and multinational companies, or will be sent by e-mail. Also, this type of campaign will use the distribution of leaflets in downtown areas with a high population flow.

The main advantage of advertising is that it offers great flexibility, with the possibility to address both to a very large audience and the possibility of concentrating on a narrow market segment.

Among the most important positive features that include commercial advertising, there is the possibility to attract very large and dispersed markets, the cost per recipient is small even if the amounts are large, and the message is broadcasted to all members of an audience and also contributes to increased sales volume. The main objective is to reach a bigger audience as possible with a reasonable cost, to inform the public of existing restaurant and to create favorable image.

Public relations will be addressed in the promotional mix of the restaurant in 15%; the main objective is to maintain positive relationships with all employees, competitors and the public, thus providing a favorable image of the restaurant.

The restaurant will create a monthly own publication that will present the current offers, discounts and also in each number of the magazine, a part of the publication will contain general information on history, culture, art or music Italy. Free distribution will be done, primarily to loyal customers at their home address and to national and multinational companies in the county. It will also create three mini-stands in representative points of Brasov, where there will be copies of the publication, so that all willing and curious passes-by can get them.

The last tool of the promotional mix, which has the less importance, but significant, is professional sales. The focus will be only in proportions of 10%, because it acts on a narrow area. Once a month, at the ground floor of My Place complex will be made sampling sessions, which will offer to consumers samples of some specific cuisine of undeniable flavor of Italian food.

#### 4. Conclusions

Promotional mix is a factor of major importance in the promotion of any organization or company, especially with functions of catering units.

It is particularly important to choose the right promotional mix and establish each element of the mix for the product offered in consumption, in order to be well received by all customers.

In the organization of the restaurant, it must be awareness that the key to attract and retain customers is meeting customer requirements through a diverse menu, impeccable quality and providing a pleasant environment in the restaurant. Therefore, the overall objective of the restaurant Maronne is to fully satisfy customer requirements gastronomy, given the fact of an increasing consumer interest in nutrition with specific other than national one.

The specific objectives pursued through promotion policy are:

- Create a positive image about restaurant and products which are offered for consumption;
- Creating interest in Italian-style cuisine;
- Maintaining the unit in customers' attention;
- Positioning the restaurant as a high level, comparing with similar restaurants or the high class restaurants in town;
- Increasing awareness among customers.

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## ASPECTS AND CONNOTATIONS OF POTATO IRRADIATION

F.V. EDU\*, A. MARCULESCU\*, C. BADARAU\*

**Abstract:** Food irradiation is the process of treating food with ionizing radiation (gamma ( $\gamma$ ) rays), with the purpose of extending the term of validity, inactivating or destroying insects, parasites and microorganisms, inhibiting the postharvest sprouting of tuber and bulbs crops, avoiding spoliation and delaying fruits and vegetables ripening. Control of insect infestation in stored agricultural commodities has been relied on the widespread use of chemical fumigants. As pointed out by Loaharanu (1994), chemical fumigants are rapidly becoming unavailable because of serious health and environmental consequences. Accordingly, the research for a safe and efficient method has pointed out food irradiation. This paper is presenting a comparative study regarding the qualitative and production results for the potatoes treated with pesticides and of the ones treated with gamma ( $\gamma$ ) rays.

**Keywords:** food irradiation, postharvest sprouting, chemical fumigants, pesticides.

### 1. Introduction

For a precisely producing of the amount of energy necessary to the desirable exposure, in the field of food irradiation, there are four radiation sources: gamma rays ( $\gamma$ ), from the radio nuclides  $^{60}\text{Co}^*$  and  $^{137}\text{Cs}^*$ , x- rays and electrons generated from machine sources. [1]

When ionizing radiation penetrates through a food product, all the amount of energy or a part of it is being absorbed by that medium. This energy, reportedly to the product' s mass is called the dose of absorbed energy (the dose). The unit of measurement for the dose is 1 Gray (Gy), that is equal to 1 Joule/kg. In the case of food radiation processing, the dose is measured in kGy (1,000 Gy).[2]

According to the dose of radiation applied, in practice, there are being used three energy levels:

Low doses (up to 1 kGy), used for: bulbs and tubers sprouting inhibition (0,03 – 0,15 kGy), delaying of fruits ripening (0,25 – 0,75 kGy), the destruction of insects and other pests, including quarantine treatments and inactivating parasites (0,07 – 1 kGy).[6]

Medium doses (1 – 10 kGy), used for: the treatment of meat and sea fruits (1,5 – 7 kGy),

the reduction of microorganisms from spices (10 kGy);[6]

High doses (above 10 kGy), used for: meat sterilization, that is shelf stable without refrigeration (25 – 70 kGy), the sterilization of food from hospitals (25 – 75 kGy).[6]

Therefore, for potato sprout inhibition, it is being used a very low dose of ionizing energy.

A run through the scientific literature shows that food irradiation is a very well tested food processing technology. Food safety studies shown that it does not generate noxious compounds in the food structure.[1] It was even declared that food irradiation is technically necessary to ensure food safety.[10] Food irradiation is contributing to the food supply of population with more safe food (by inactivating pathogenic microorganisms) and with great amounts of food (by enhancing the term of validity). Thereby, as long as Good Manufacturing Practices (GMP) are respected, food irradiation is a safe and efficient preservation technique.[1]

Food irradiation is probably the most extensively tested food processing technique, for the assessment of toxicological safety from the whole history of food preservation.



Studies regarding the safety and the nutritive quality of irradiated food are dating from the former 1950's. Hundreds of short or long term safety studies lead to the improvement of one or more food to be irradiated, at present times in more than 60 countries.[3]

In compliance to the studies attained under the aegis of some international organisms, food irradiation is intended for a large scale of food products, it is efficient and has minimum influence upon the functional or organoleptic properties of food treated at commercial doses.[1]

The labeling of irradiated food, designed for the final consumer or for public alimentation, has to comply to the following:

If food is commercialized by piece, on the label, the words "irradiated" or "treated with ionizing radiation" have to be mentioned;

In the case of products sold in bulk to the ultimate consumer, the international logo and the words "irradiated" or "treated with ionizing radiation" should appear together with the name of the product on the container in which products are placed.[9]

For food products sold in bulk, that are being transported in containers, the declaration of the fact that the product has been irradiated must be mentioned in the relevant shipping documents.[9]

## 2. Materials and Methods

In this chapter, it is being presented a comparative analysis of pesticide treatment of potato and the technique of irradiation, having regard to the conditions of storing, but also to the physiological processes that take place during this period.

During potato storing, inside the tubers take place a series of physiological processes, like respiration, transpiration, sprouting or mycotic or bacterial infections. As this processes have a lower intensity, the losses in the potato mass during storage are smaller.[8]

Potato sprouting during storage is an unwanted physiological process that leads to

weight losses, the adulteration of their qualities and difficulties regarding their manipulation. In the first period of time after harvesting, tubers are in a process of vegetative pause. This process is depending upon the variety of potato, but also on the vegetation conditions. Usually, this process lasts two or three months. The incorrect adjustment of storing temperatures may lead to the reduction of the vegetative pause and to the potato sprouting.[8]

The parameters for potato storing are as following: a temperature at about 3 – 8 °C, air moisture of 85 – 90 %, and an air composition close to the composition of the atmospheric air (20 – 21 O<sub>2</sub> and 0,003 % CO<sub>2</sub>).[4], [8].

For the lengthening of the vegetative pause and the delaying of potato sprouting, the potato is being treated with chemical substances, like: MENA (methyl ester of the  $\alpha$  – naftilacetic acid), CIPC („Keim - Stop" izopropyl – n – clorphenylcarbamate), IPPC („Superspot" izopropyl – n – phenylcarbamate), maleic hydrazide.[4]

After pesticide treatments, the problem of the residues of this substances in the agricultural product, but also in the food products is of great concern for consumer' s state of health.

Carbamates have been involved in a great number of toxic incidents, as a consequence of professional exposure, but also due to the consumption of contaminated food.[2] The residues of this insecticides have a neurological effect, based on the blocking of the acetylcholine' s activity. Thereby, some disturbances like hyper salivation, intense transpiration, sickness, regurgitation, diarrhea, mydriasis, and even death.[2]

In comparison to the pesticide treatment of potatoes, the irradiation treatment doesn't affect the environment, doesn't leave residues in the food, nor in the environment.

In many regions, tuber and bulb crop production through the year is not possible and therefore, postharvest storage technologies are required to provide consumers with stable supplies of these

commodities. Also, these crops are important items of international trade.[3]

Sprouting of tuber and bulb during storage can be detrimental to their nutritive value and marketability. The undesirable changes that occur during sprouting include loss of marketable weight

and nutritive value, softening, shriveling, loss of processing qualities, temperature buildup associated with respiration rate, susceptibility of bruising and problems with sorting and grading of sprouted materials. The sprouts contain increased levels of the toxic alkaloid solanine.[3]

*Table 2.1. – A comparative analysis of irradiation and pesticide treatment*

Irradiation treatment	Pesticide treatment
<ul style="list-style-type: none"> <li>• The use of very low irradiation doses (0,03 – 0,15 kGy);</li> <li>• The proven safety of irradiation;</li> <li>• Irradiation treatment doesn't affect the environment, doesn't leave residues in the food, nor in the environment;</li> <li>• It reduces the solanine content in potato;</li> <li>• A smaller quantity of reducing sugar of irradiated potatoes;</li> <li>• Irradiation does not generate changes in the digestibility (net protein utilization) or in the biological value of the proteins, due to the use of 0,08 kGy;</li> <li>• Vitamin C is stable; the quantities of thiamine, riboflavin and niacin are not reduced; it has been observed even an increase of the riboflavin;</li> <li>• Great attention to potato manipulation during and after irradiation.</li> </ul>	<ul style="list-style-type: none"> <li>• The problem of the residues of these substances in the agricultural product, but also in the food products is of great concern for consumer's state of health.</li> <li>• The residues of these insecticides have a neurological effect, based on the blocking of the acetylcholine's activity.</li> <li>• The use of this chemical substances is about to enter under a strict examination, because of their poisonous effects upon the environment, but also on consumer's health;</li> <li>• Some chemicals currently in use have shown to have adverse health effects, and it is likely that their use will be limited or even restricted;</li> <li>• In some countries, like Japan, the use of chemical substances for potato sprout inhibition is forbidden.</li> </ul>

### 3. Results and Discussion

#### 3.1. The effects of irradiation on the nutritional components of potato

##### 3.1.1. The effects of irradiation on sugars

Results reported in the literature are variable, which could be attributed to cultivar variations, time of treatment and storage temperature. A temporary rise in both reducing and no reducing sugars may occur immediately after irradiation, which often returns to normal levels during storage, followed by an increase during prolonged storage.

A pre storage at temperatures of 2 - 15 °C, as the post irradiation storage at temperatures of 2 °C, maintain the sugar levels constant

and a greater quantity of sugar is observed, compared to the non irradiated samples.[3]

##### The effects of irradiation on proteins

Some changes have been found in the concentrations of free amino acids in potatoes, without any alterations in the amino acid constituent of the protein (OMS, 1997).[3]

It was noticed a difference in the content of free amino acids and proteins of irradiated and non irradiated potatoes.[3] A study on the nutritional quality of potato proteins based on the balance of nitrogen, in the rates of growth, amino acid content and lysine, showed no significant effects on the digestibility (net protein utilization) or protein biological value due to irradiation at 0,08 kGy.[3]

##### 3.1.2. The effect of irradiation on vitamins

Since potatoes are a good source of vitamin C (ascorbic acid), some researchers have

studied the stability of this vitamin. Vitamin C is stable, during and after irradiation. Although a reduction of vitamin C level of 15 % has been observed during the early storage period following irradiation, its content in stored tubers is reported to be even greater than of non irradiated tubers stored under identical conditions.[3]

Also, a part of the ascorbic acid is converted to dehydroascorbic acid, a compound that is biological active.[3] The content of vitamins like thiamin, riboflavin and niacin weren't reduced because of radiation treatment at sprout inhibition doses. It has been observed an increase in the content of riboflavin with the increasing dose.[3]

### 3.2. The effect of irradiation on the content of chlorophylls and glycoalkaloids

Potatoes irradiated at sprout inhibition dose levels were found to be more resistant to light – induced greening due to chlorophyll formation. Under normal conditions, greening starts to be a problem after 3 days in the supermarket, irradiation may delay this period for 9 days.[3] Since solanine formation accompanies greening, it would be reasonable to assume that irradiation may also delay the formation of solanine.[3]

### 3.3. The effect of irradiation on the technological properties

Many studies have indicated that when good quality potatoes, suitable for long – term storage were irradiated and not mishandled during and after irradiation, there was no effect or only slight effect on the rate of decay during storage.[3] Comparative studies regarding processing qualities of potatoes that were treated for sprout inhibition by irradiation or by using pesticides, didn't show significant differences, that may affect the processing qualities of the agricultural product.[3]

## **4. Conclusions**

Although sprout inhibition of tuber and bulb crops has been one of the important applications of radiation processing studied

worldwide since the 1950s, this technology is yet to be used on a commercial scale.[3]

Consumer acceptance studies undertaken in many countries have shown the techno economic feasibility of the process and positive consumer attitude to buy irradiated food if made available on the market.[3]

However, industry interest is still very low, for a variety of reasons. These factors include the high capital investment, perceived consumer opposition to irradiated food, regulatory and trade aspects, labeling requirements and the need for storage under controlled temperatures.[3]

The processing quality characteristics of irradiated potatoes are reported to be excellent, because of their low reducing sugar content.

Under temperate climates, storage of potatoes at 7 - 10 °C, together with the use of chemical sprout inhibitors, provide inexpensive and satisfactory sprout control with reasonably good product quality.

However, the use of chemical substances is coming under increasing scrutiny, because of environmental pollution and health risk from the residues left in the product. Some chemicals currently in use have been shown to have adverse health effects and it is likely that their continued use will be restricted.[3]

In tropical countries, long – term storage of potatoes under ambient conditions is not practical, because of microbial rotting; it therefore becomes necessary to use irradiation in conjunction with cool storage at temperatures of 10 – 20 °C. In some countries, like Japan, the use of chemicals for sprout inhibition of potatoes is not permitted, so irradiation seems to be a promising solution.[3]

Good tuber and bulb crop handling and storage management practices are essential prerequisites for their successful on a commercial scale.[3]

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## IRRADIATION ADVANTAGES OF SPICES, MEDICINAL PLANTS AND DRIED FOOD PLANTS

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**Abstract:** Food irradiation is the process of treating food with ionizing radiation (gamma ( $\gamma$ ) rays, from the radio nuclides  $^{60}\text{Co}^*$  and  $^{137}\text{Cs}^*$ , x-rays and electrons generated from machine sources), having the main purpose of destroying pathogen and un-pathogen bacteria, parasites and also viruses. Food irradiation has two main aims: preventing food wastage and microbiological decontamination. In the case of radiation treatment of spices, medicinal and food dried plants, the goal is to reduce the microbial population, ensuring their hygienic quality. The ionization of food and agricultural products is attending the biocide effects: the insecticide effect (for grains, tobacco), the fungicide effect (for spices, dried fruits and vegetables, coffee) and the bactericide effect, as to eliminate pathogen bacteria (*Salmonella*, *E. coli*). This paper is presenting the advantages of irradiation treatment of spices, dried medicinal and food plants, to ensure their hygienic quality and microbiological stability.

**Keywords:** food irradiation, hygienic quality, biocide.

### 1. Introduction

Food irradiation is the process of treating food with ionizing radiation and implies a controlled exposure of foodstuff, to a source of ionizing radiation of well known energy.[1]

When ionizing radiation penetrates through a food product, all the amount of energy or a part of it is being absorbed by that medium. This energy, reportedly to the product' s mass is called the dose of absorbed energy (the dose). The unit of measurement for the dose is 1 Gray (Gy) that is equal to 1 Joule/ kg. In the case of food radiation processing, the dose is measured in kGy (1,000 Gy).[1]

According to the dose of radiation applied, in practice, there are being used three energy levels:

Low doses (up to 1 kGy);

Medium doses (1 – 10 kGy), used for microorganisms reduction in spices, for the improvement of the hygienic quality (10 kGy);

High doses (above 10 kGy). [4]

Irradiation treatment of foodstuff has many advantages, like: enhancing the preservation, destroying or inactivating insects, parasites, sprouting inhibition, the reduction of food allergens. Irradiation reduces the quantities of

nitrosamines or biogenic amines, the rise of the hydration rate of vegetables, the rise of the speed of drying for fruits, a reduction of the cooking period for some vegetables.[2]

Organisms like *World Health Organization (WHO)*, *Food & Agriculture Organization (FAO)* and *International Atomic Energy Agency (IAEA)* had been financing for years research programs to clear up the aspects of food irradiation treatment. Hereby, there have been settled all the biological, nutritional and toxicological implications of food irradiation.[1]

Food irradiation can ensure population supply with safer foodstuff (by inactivating pathogen microorganisms) and with higher quantities of foodstuff (by increasing the validity period). So, as long as Good Manufacturing Practices (GMP) requirements are respected, food irradiation is a safe and efficient food preservation technique.[1]

### 2. 2. Materials and Methods

In this chapter are being presented the microbiological risks that may be present in spices and medicinal and food dry plants, in correlation with the microbiological parameters that this products have to possess.

Thus, the solution for the adjustment of these unconformities is the application of food

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irradiation, having the aim of improving the hygienic quality. Spices and herbs have been important items of international trade for centuries. Generally, the microbiological quality of spices and herbs reflects the hygienic situations of the regions where production takes place and also to their handling.[3]

Although better hygiene during postharvest handling of these commodities could improve their microbiological quality, microbial contamination is inevitable under the conditions of production, harvesting and postharvest handling conditions. Therefore, most dried food ingredients of vegetable origin may contain large numbers of microorganisms that may cause spoilage or defects in the composite food to which they are added, or more rarely could cause food borne diseases. Dried vegetables, which are commonly used as soup ingredients, also contain a large number of microorganisms.[3]

Spices and herbs in their natural state contain those microorganisms indigenous to the soil and plants where they are grown and that survive the drying process (Kneifel and Berger, 1994). Dust, insects, fecal material from birds and rodents and also the water used by some processors are all important sources of additional contamination.

A wide range of bacterial and fungal species has been identified in spices and herbs. Bacterial counts in these products vary from  $10^4$  –  $10^7$  per gram. Although the microbial content of spices vary greatly, in general, black pepper, turmeric, paprika, chili and thyme are the most contaminated spices.[3]

Bacteria like *Bacillus cereus* and *Clostridium perfringens*, that are capable to cause gastroenteritis when ingested in large number are frequently found in spices, but usually in low numbers. However, in extreme cases, *B. cereus* counts up to  $10^5$  CFU/ g have been found. Several other *Bacillus* spp., that are opportunistic pathogens, occasionally involved in food poisoning, are more frequently isolated from spices. Since their spores may survive cooking, ingredients harboring these spores must be considered as a potential health hazard.[3]

*Salmonella* has been found, although infrequently, in a variety of spices (Satchell et al., 1989). However, its presence is of great concern, when spices are used in food that are consumed raw or when the spices are added to food after cooking.[3]

In 1993, a national outbreak of salmonellosis occurred in Germany, following ingestion of paprika and paprika powder potato chips contaminated with a great variety of *Salmonella* serovars. From the estimated 1000 cases, children aged less than 14 years were mainly affected (Lehmacher, 1995).

This is the largest documented outbreak, that proved that even extremely low numbers of *Salmonella* adapted to the dry state could cause illness.[3]

Mold counts of spices and herbs may reach to  $10^5$  CFU/ g level, and also a high incidence of toxigenic molds have been found. The mold genre *Penicillium* and *Aspergillus* are common, and hence, mycotoxins may be present.[3]

Medicinal plants also have an abundant and varied micro flora. Roman chamomile, lemon balm and peppermint showed bacterial loads that ranged  $10^5$  to  $10^7$  CFU/ g fresh weight (Tharreau et al., 1992). Some herbal products sold as „health food” also proved to be of dubious microbial quality (Thomas et al., 1977).[3]

One has to bear in mind that even regular microbial contamination of dietary dry ingredients may pose a health hazard to the growing number of severely immune compromised individuals.[3]

Batches of dried food ingredients must satisfy health and sanitary regulations and establish quality standards and other requirements imposed by the authorities or by users.

Thus, there is a need to adopt and apply measures and methods that ensure quality and microbiological safety at all stages (production, postharvest, handling, storage, packaging, transportation, processing and distribution.

Recognizing all the above mentioned hazards, the application of Good Hygienic Practices (GHP) and the Hazard Analysis of Critical

Control Points (HACCP) concepts are of importance in the field of dried ingredients.[3]

Good manufacturing practices and HACCP applied to dried commodities should consider the whole process, including production in the countries of origin. However, importers, lack direct control in exporting countries and this diminishes CCP opportunities. Therefore, the need for microbial decontamination treatments for spices and herbs is an important question.[3]

### 3. Results and discussion

Until the early 1980s, the most widely used method to destroy microorganisms in dried food ingredients was fumigation with ethylene oxide, or with propylene oxide.

Because of toxicological considerations, the use of ethylene oxide has been discouraged or even banned for food uses in the European Union.[3]

A number of alternative technologies have been developed for decontaminating dried food ingredients. However, none of them match the applicability of treatment with ionizing radiation, because of their low antimicrobial efficiency, changes in flavour and color, loss of functional properties.[3]

Experiments and practical applications on a large variety of dried food ingredients, since the 1950s, proved that radiation decontamination is a technically and economically feasible and safe physical process. The irradiation process is direct, simple, requires no additives and is highly efficient. The microbicide effect of irradiation is less dependent on the moisture content of dried ingredients than are alternative technologies and irradiation allows treatment of commodities in a wide range of packages.[3]

Irradiation has a very strong antimicrobial effect. Radiation doses of 3 – 10 kGy reduce the total aerobic viable cell counts even in highly contaminated spices and other dry ingredients to below  $10^3$  –  $10^4$  CFU/ g. Recontamination can be prevented because irradiation can be applied to products as a terminal treatment, in their final packaging.[3]

Some residual antimicrobial effect could be noted during storage of irradiated samples, as a function of moisture content, longevity of free radicals and DNA damage in surviving microorganisms. Furthermore, the microflora that survived had lower heat and salt tolerances and was more demanding in terms of pH, moisture and temperature requirements for growth than was the untreated microflora. These facts reduce the ability of residual microflora for survival and growth in processed food products.[3]

#### Spices, herbs and dried – vegetable condiments

In various types of paprika, irradiation at 6,5 kGy was found to be more effective than ethylene oxide treatment. Gamma radiation was more effective than ozone treatment, in reducing the microbial load of aloe powders. To eliminate mold contamination, doses of 5,0 – 7,5 kGy are sufficient.[3]

Total carotenoids in ground paprika were unaffected by treatment with 5 kGy during storage for 250 days (Farkas et al., 1973). The antioxidant properties of spices reportedly remain unaltered by radiation decontamination treatments (Kuruppu et al, 1985). No loss of vitamin C was observed in onion powder, even when a 20 kGy dose was applied.[3]

No substantial changes were found in oil content of most spices treated at doses up to 10 – 15 kGy. Ginger and juniper seem to lose some of their volatiles as a result of irradiation. The components of essential oils of rosemary and black pepper, however, were not changed even at 50 kGy irradiation.

Complex dried products such as spices are less affected chemically by irradiation, than their pure aroma compounds or high – moisture foodstuff.[3]

Sensory analysis and practical food applications indicate that at 4 – 10 kGy, doses sufficient high for „pasteurization”, no significant differences exist between irradiated samples and controls, from an overwhelming majority of spices and herbs. In some cases, the sensory quality of certain spices was reportedly

better after irradiation than after ethylene oxide treatment.[3]

The chemical stability of stored spices does not seem to be affected by radiation decontamination (Farkas et al., 1973). Various meat products that were prepared with spices that were irradiated up to 20 kGy could not be distinguished by flavour from the ones prepared with non-irradiated spices.[3]

#### Herbal teas and dried medicinal plants

Some studies on improvement of ginseng powders by gamma irradiation indicated that their physicochemical properties were not affected by this process (Byun et al., 1997).[3]

#### Dried fruits and vegetables, dry soups and cereal products

No deterioration of chemical and sensory properties was observed in dry leek irradiated at 5 kGy. Changes in color and flavor were reported to be minimal in some products even at doses as high as 10 kGy (Kiss et al., 1974).[3]

Radiation decontamination of dehydrated vegetables at doses up to 10 kGy may offer advantages to processors, because it reduces product hardness and increases water absorption capacity.[3]

However, certain vegetables (asparagus, mushrooms and onions) may undergo browning (Wilkinson and Gould, 1996).[3]

Cereal products that are used as ingredients in some dairy products and cannot be thermally processed, may also be considered for radiation decontamination. The spoilage of white bread has been shown to decrease when irradiated flour is used to make the bread (Farkas and Andrassy, 1981).[3]

#### Protein and enzyme preparations

Soy flour and other protein preparations (sodium caseinate, powdered whey) may be treated at 5 – 10 kGy, without appreciably altering their physicochemical and organoleptic characteristics. Doses around 10 kGy reduced to negligible levels the microbial load of several

industrial enzyme preparations, without affecting enzymatic activity.[3]

## 4. Conclusions

Some factors support the economic feasibility and industrial use of radiation decontamination of dried food ingredients:

- unlike other technologies, radiation treatment is easy to automate and can be applied as a continuous process;
- irradiation decontamination can be applied to materials in their final packaging;
- the technology can be applied the whole year;
- the radiation doses required to achieve practical decontamination are moderate;
- because of their compactness, high value and transportability, irradiation of packaged dried ingredients can be done in centralized facilities and/ or on a service base;
- the demand for decontaminated dried ingredients is increasing and therefore achieving high microbiological quality products is very important.[3]

In a study comparing the economics of irradiation and ethylene oxide fumigation of spices and vegetable seasoning, the cost of irradiation was greater than that of fumigation, but the advantages of irradiation were considered to offset the increase in price (Modak, 1993).[3]

Irradiation is a recognized method for reducing the microbial load of dried food ingredients. Legal clearances have been granted in many countries for irradiation of spices and herbs (ICGFI, 1996).[3]

An increasing number of countries irradiate these commodities for commercial purpose and commercial – scale irradiation is increasing from year to year. Irradiation of spices on a commercial scale is practiced in more than 20 countries and global production has increased from 5 000 tons in 1990 to over 60 000 tons in 1997.[3]



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# PRELIMINARY STUDIES REGARDING THE USE OF INFRARED IMAGING IN THE DRYING PROCESS OF VEGETAL PRODUCTS

E. SCHUR\*

O. B. OPREA\*\*

**Abstract:** Food is very sensitive to heat impact and suffers deformation while drying. Noninvasive methods for determining the drying process quality are vastly researched to prevent damage on the products. Infrared imaging allows the non-contact observation of product's temperature changes and was done by recording the drying process of vegetal products with an infrared camera and analyzing the images with LabVIEW. The research described in this paper shows the results and advantages of applying infrared images for controlling product temperature during drying process.

**Keywords:** infrared images, drying, food processing, LabVIEW

## 1. Introduction

Many properties determine the quality of a drying process for food products. On the one hand, engineering properties define an efficient and profitable process and determine control over the equipment. On the other hand, the aim of drying comprises of the production of preserved food of the best possible quality. Properties considered to determine product quality are structural, optical and textural changes as well as the loss of nutrition and flavor after drying.

The execution of the drying process influences the product quality a lot and can change the sorption characteristics of materials. In industrially operated drying the dryer's air is constantly controlled of temperature, velocity and moisture. Elaborated dryer settings need to be done to ensure product structure, texture and color, to reduce degradation reactions and to acquire the desired food properties.

During drying, the food product's moisture is carried away by hot, dry air. The resulting dehydrated product is of different shape, shrinks and deforms due to water loss. Also, diffusion of water molecules causes cracks in the solid structure. Drying causes injuries on the structure of food products and these cannot be restored by a simple addition of water.

Drying of food products also contains knowledge about color change, which is important for customer's acceptance of

dehydrated foodstuff. Color change is undesired for many products and can be caused by evaporating surface water and certain chemical reactions like enzymatic browning, non-enzymatic browning and caramelization reactions. The drying method can influence product color a lot, whereas conventional air drying causes more color changes than freeze-drying or microwave drying [1].

Furthermore the removal of moisture during drying effects the texture of food. Dried food crumbles and has a different mouth-feeling as when it was fresh. The textural changes are especially important for products that are rehydrated before usage and good knowledge about the compression behavior is required.

## 2. Problem Formulation

Drying is done by the simultaneous supply of hot air and the removal of moisture from the dehydrated product. In Figure 1 a typical drying chart is shown. During this process, the product's temperature, shown as red line, rises constantly. At the end of the falling rate period, the product's temperature finally starts to increase to a temperature that can cause damage to the product.

For thinly sliced products, the surface temperature differs only little from the interior temperature and can be directly observed. Non-invasive measurement methods are vastly

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researched and developed nowadays for this purpose. The goal is to minimize food's structural, textural and optical changes that are linked to heat influence and dehydration during the drying process. There are several technologies on the market, of which some are very complex. An easy-to-use and yet representative method is the monitoring of images from an infrared camera.

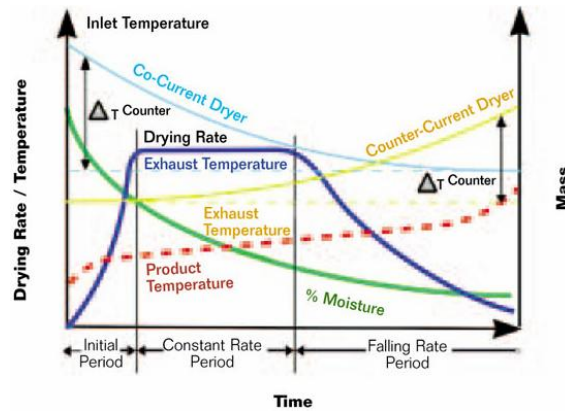


Fig. 1: Typical drying curve [2]

In 1929, the first infrared camera was developed by Kálmán Tihanyi as equipment for torpedoes and guns for the British Army [3]. Since then, the field of application for this technology has greatly extended and infrared cameras are not only used anymore for military purposes, but also for predictive maintenance inspections in industries or for firefighting.

The technology used for this type of cameras is based on capturing infrared wavelength and converting it into an image, which can be in grey values or colorful. Infrared radiation is invisible to human's eye, but can be felt as heat on the skin. Any object above absolute zero ( $-273,15^{\circ}\text{C}$ ) emits infrared radiation and the warmer an object, the more radiation it emits.

An infrared camera is a useful non-invasive measurement tool which can scan and visualize whole areas of interest at once. In comparison to other measurement tools like infrared thermometers, that capture only the temperature of one spot, the infrared camera which was used has  $240 \times 240$  pixels and can show therefore  $240 \times 240 = 57600$  temperature values.

The direct observation of drying processes by infrared cameras has already been experienced for paper and wood industry. This study emphasizes the application of this technology for thinly sliced vegetal products. The parameters measured during the experiment were maximum,

minimum and mean temperature of a certain image section. Temperature distribution and uniformity could be derived from the results. During the observation classic humidity and temperature sensors were used to verify the results.

### 3. Equipment and method

#### 3.1 Experimental design

A conventional dryer with a movable tray wagon shown in Figure 2 was used for this research. The infrared camera of the type FLIR i50 was adjusted on a tray and focused towards the product. A special tray made of mesh fibers was used to allow good heat transfer between product and drying air. Due to the fact that the infrared camera has an operating temperature until  $50^{\circ}\text{C}$  overheating had to be prevented. The infrared camera was connected to a computer and sent infrared images in desired intervals (using VLC network stream and automatic image capturing). For the experiment described in the following it was set for intervals of 10 minutes. The images were saved on the computer for a later analysis.



Fig. 2: Design of experiment

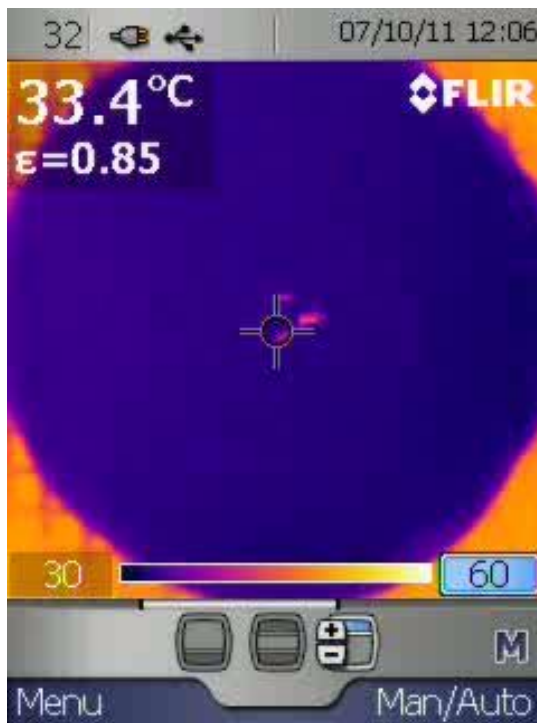
Temperature and humidity of the air inside the dryer and of the room were continuously measured and recorded with a NOVA5000 device and the provided sensors shown in Figure 3. Later, the record was used as supervision of the drying process.



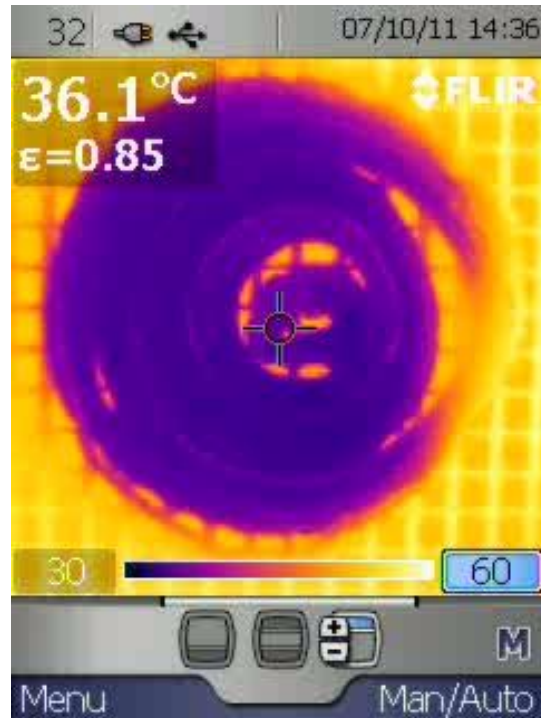
Fig. 3: Humidity and Temperature sensors provided with Nova5000 bundle.

### 3.2 Image analysis

Infrared pictures were shot during the whole process. Representative images are shown in Figure 4 from the beginning, middle and end of the drying experiment.



a) after 6 mins



b) after 156 mins



c) after 323 mins

Fig. 4: Infrared images

The analysis from the acquired infrared images was done with a program written in LabVIEW. This program is shown in Figure 5. Before the start of the analysis, some settings need to be done and there is required information for the

program to run correctly. The measured temperature range, defined on the infrared camera, has to be typed into the LabVIEW program. Also, since there are advertising and operation information on every image and the background next to the product is recorded and adulterates the result, a certain extract of the infrared image can only be used for the analysis. This also has to be considered in the LabVIEW program.

The LabVIEW program (Fig 5) converts the pixel values into temperatures and calculates the maximum, minimum and average value of every infrared image. Conclusions and temperature uniformity can be derived from these results.

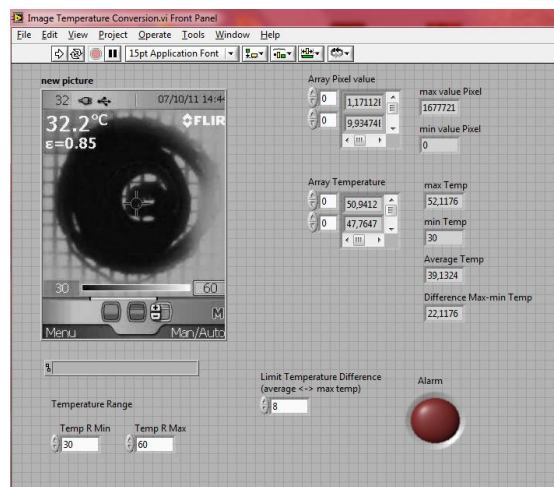


Fig. 5: Front panel of the LabVIEW program

#### 4 Results and discussion

Onions were dried at 55 °C while being monitored during the drying process by infrared images. In Figure 6 the temperature profile for minimum, maximum and average temperature of an onion slice is illustrated.

The analysis was done with the LabVIEW program and showed clear results. Implemented in the dryer is a PID regulation. During the process, the dryer always turns on the heater when air is 52 °C or below, and turns off the heater when air temperature reached 58 °C. The curves are never steady, but always going up or down depending on the heater. This also influences the product.

The maximum temperature refers to the surrounding air in the dryer, shown on the infrared images as the brightest parts and being not the product, but the background of it. During the drying process, the air was heated up first and reached at peak times about 60 °C.

The minimum temperature shows the wettest part of the onion slice. This part remains dark on the infrared image, with a low temperature. It only starts drying in the end when the temperature finally starts to rise and also the wettest part becomes dry.

The average temperature indicates the mean temperature of the extracted infrared image. It can be seen, that in the beginning the onion slice remained wet and cold. With the continuing of the drying process the average temperature rises and the onion slice becomes hotter and dryer at the same time.

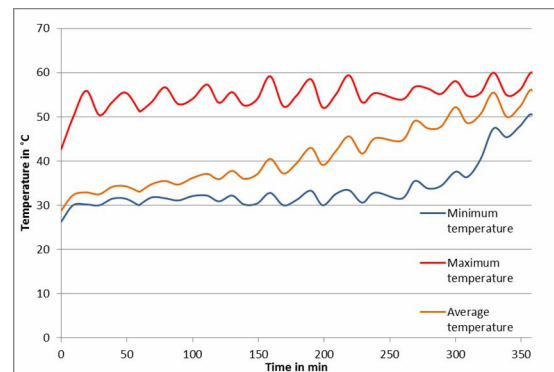


Fig. 6: Temperature profiles of onion slice

An indication for product quality during drying is temperature uniformity. Temperature uniformity can be mathematically assessed by dividing minimum temperature through maximum temperature. The resulting values range between 0.01 and 1. A very low value stands for high diversity of temperature in the infrared image, whereas a high value indicates evenly distributed temperatures. The temperature uniformity of the onion slice is presented in Figure 7. The red curve shows the theoretically ideal curve. The curve shows, that in the beginning of the drying process, everything is cold and has the same temperature. When the dryer starts to heat up, he brings a lot of hot air to the product. Hot air causes high maximum temperature, whereas the minimum temperature doesn't change and remains low. Only after 270 minutes the product starts to heat up and assimilates to the air temperature. In the end, maximum and minimum temperature have again the same temperature and the ratio is 1.

It can be seen that there are some major differences between the theoretical and measured curve. For once, the infrared imaging started when the dryer was already heated up. There was

not the same temperature in the beginning and so the curve doesn't start at 1. Meanwhile the process, the ratio remained the same at around 0.6, until the curve starts rising after 270 minutes. The highest reached ratio in the end is only 0.85 which means that there were still parts in the infrared images left that remained colder. This is due to the fact that the drying process was aborted before the product was completely dry.

Products should be carefully dehydrated to maintain their good quality properties. With utilizing temperature uniformity a drying process can be stopped until it dried too much. This method makes sure that product quality can be ensured.

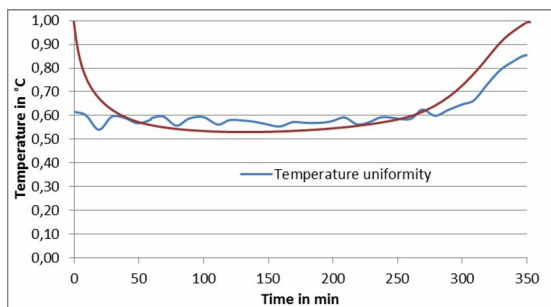


Fig. 7: Temperature uniformity

## 5 Conclusions

1. The application of infrared cameras for the observation of drying processes gives representative information about the temperature profiles of the products. This information can be transformed into temperature uniformity and ensures product

quality. A lot of research can still be done on this field to implement a regulation for the dryer. This would have the advantage of an automatic adjustment of the dryer's temperature to the product and abortion of the drying process at the end for a more gentle drying process and to ensure better product quality.

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# EXPERIMENTAL RESEARCH ON THE POSSIBILITY OF PHOTOVOLTAIC PANEL USE IN THE AGROTURISTIC ZONE OF SANPETRU-BRAȘOV

O. B. OPREA\*<sup>1</sup> E. SCHUR \*\* L. GACEU\*

**Abstract:** The paper present some researches in order to evaluate the potential of the use of solar power in photovoltaic panel in agricultural pension. The area looking to was the agritouristic zone of Sanpetru-Brasov in the spring time of the year. The method and the material used for the experiments consist also an optimum solution for small garden flood. The price for the solution proposed not exceed 40 euro, being convenient even for small farms.

**Keywords:** Photovoltaic panel, solar power, sustainable tourism

## 1. Experimental research on voltage-current characteristic for a low power panel.

### 1.1. General considerations in the Sanpetru-Brasov region

In order to evaluate the possibilities of using solar energy in the field of agro-farms, we aimed to install a small power installation for plant irrigation in a garden from a small fountain in Sanpetru-Brasov.

The installation consists of a pump designed for water supply for camping caravan, powered directly by the energy obtained from the photovoltaic panel with an output of about 20 V.

The pimp is submerged at a depth of about 5-10 m, from ground level (water pump), water being pushed to the surface through a hose section of about 6 mm<sup>2</sup>.



Fig. 1. Position in Sanpetru-Brasov of the PV panel shows on Google Map

The fountain is drilled to a depth of 12m, the water level is going up to about 5,5m.

With a GPS receiver it has been measured the following coordinates of the place in which is mounted the solar panel: Latitude: N45, 7126700°, Longitude: E25, 63329316°, Altitude: 532 m, which were introduced in Google map and shows de figure 1.

### 1.2. Materials

For the next experiments, were used the following materials:

- Solar panels: was used a 20 W photovoltaic panel 250 x 200 mm;
- Pump MAAS 10 L (12 V) (fig.2.)
- Fountain 1,5 inch from galvanized sheet
- Hose Refitex Cristallo (10 mm exterior, 5 mm interior)
- Wire cable (20 m, 2 X 1,5mm<sup>2</sup>)
- Digital multimeter AG 3900
- Digital multimeter MY 68

#### 1.2.1. Pump MAAS 10 L

The pum used has the following characteristics:


Description	MAAS
Product code	H241000
Price	5,46 E
Voltage	12 V
Pressure	0.6 Bar
Consumption	5-10 W
Capacity	10 L/min.

The pump has common utilization in the trailer area and it is showed in figure 2.

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<b>Display LCD</b>	30 x 60 mm, 3999 
<b>Voltage DC</b>	326mV±(0.5%), 3.26V/32.6V/326V±(0.3%), 1000V±(0.5%)
<b>Voltage AC</b>	3.26V/32.6V/326V/700V±(0.8%)
<b>Current DC</b>	326µA/3.26mA/32.6mA/326mA±(1.2%), 10A ±(2.0%)
<b>Current AC</b>	326µA/3.26mA/32.6mA/326mA±(1.5%), 10A ±(3.0%)
<b>Resistance</b>	326Ω/3.26kΩ/32.6kΩ/326kΩ/3.26MΩ±(0.8%), 32.6MΩ ±(1.2%)
<b>Capacity</b>	326nF/32.6µF ±(3.0%)
<b>Frequency</b>	32.6kHz ±(1.2%), 150kHz ±(2.5%)
<b>Check diodes</b>	(Ia I=1.0mA, U=2.8V)
<b>Check transistors</b>	(hFE: 1~1000)
<b>Automatic Disconnection</b>	(in cas of neutilization)
<b>Power</b>	1 x 6F22 (9V)
<b>Size</b>	91 x 189 x 31.5 mm
<b>Weight</b>	310g (including batteries)

To achieve the current measurement and current consumed by the pump intensity, it is used a digital multimeter, shown below, with the following features:

## 2. Working method

The panel was mounted on the roof of a light wooden building, at a height of about 3 m, being oriented to the direction of S-S-W.

title must be as short possible. If necessary, a subtitle is provided.

With a wire cable the power collected is used for the pump MAAS 10L. Also it was mounted one of the multimeters for measuring electric current intensity and the other multimeter was mounted to measure the voltage.

In the figures below are presented: the constructive scheme of the installation (fig. 3.) and the electrical installation scheme.(fig. 4.)

On May 23, 2011, from 15:45, it has been made a total of five measurements for voltage and power, simultaneously. Based on these measurements, power was calculated at each time.

Subsequently, using Excel, graphs were drawn by variation of voltage, current and power, for each time separately.



Fig.2. Pump MAAS 10 L

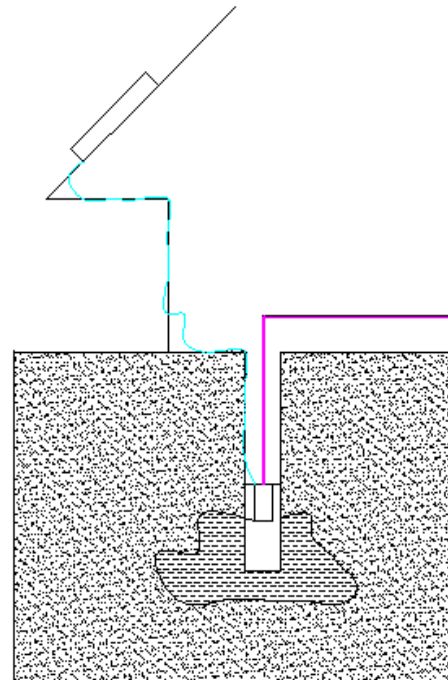


Fig. 3. The constructive scheme of the installation, drawn in AutoCAD

### 1.2.2. Digital multimeter



Table 2

## Determination of the Solar Power Supply

Hour of determination	Voltage , V	Electric current intensity A	Power consumed by the pump
15:25	9.16	0.638	5,84408
15:30	9.27	0.635	5,88645
15:35	9.09	0.623	5,66307
15:40	8.45	0.63	5,3235
15:45	8.35	0.633	5,28555

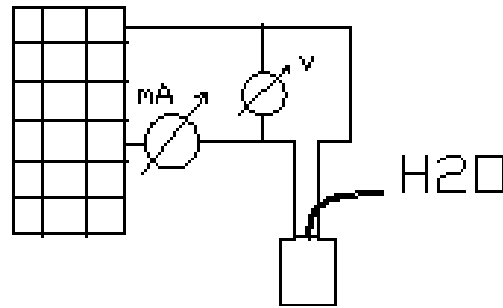


Fig. 4. The electrical installation scheme

### 3. Obtained results

In the following diagram it is shown the variation of voltage, of the intensity and the pump absorption power. It can be seen the correlation between the three sizes depending on the variation of light intensity at the time.(Fig. 5)

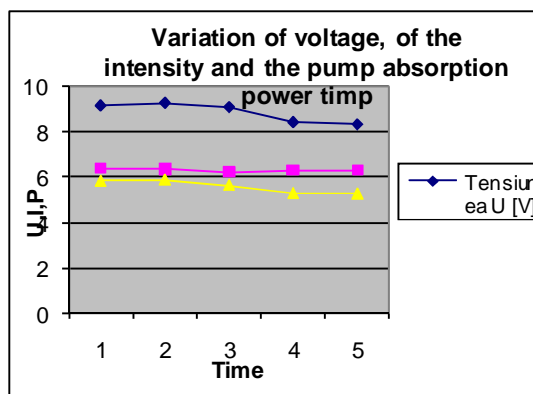


Fig. 5 Variation of voltage, of the intensity and the pump absorption power.

Experiments have resulted in providing a water flow of about 0.5 L/min., which compared with the pump flow, rate is 5%. The results from measurements are presented in the table 2:

This is mainly due to low voltage, supplied by the solar panel, so future research direction will be considered using the same pump power with voltage of 7.5 V.

Even under low flow of 0.5 l/ min, held for a period of 2 hours/ day, it can be obtained an aggregate of 60 l/ day, 420l/ week. This element highlights the high potential of the proposed

solution and opens the opportunity for experimentations in this direction.

### 4. Conclusions

Renewable energies have some advantages such as: they are ecological, don't generate CO<sub>2</sub> emissions, and theoretically are available in unlimited quantities.

A large amount of heat is found in the field of infrared radiation and not in the visible radiation, radiation that can be effectively captured in solar vacuum tube whit heat pipe.

Advantages of using solar panels are represented by the possibilities that can ensure electricity in isolated locations without access to electric power supply network.

Efficiency of solar cells depend on to factors: the intensity of solar radiation incidents on the cell surface, energy conversion efficiency of solar radiation in electricity.

At present, construction of photovoltaic cells are efficient at around 15%, which is quite a low value. For this reason, photovoltaic panels are mainly located in areas characterized by intense solar radiation, however, countries like Germany and Austria are examples of the widespread use of this technology, although are not favored country's, in terms of solar radiation intensity.

Romania is in the "B" European sunlight area; Compared with the solar map of Italy and considering kWh/m<sup>2</sup> average solar day, we see that only southern Italy and Sicilia have higher solar flux.

Brasov - Sanpetru zone is situated in a geographical area that has an average heatstroke of about 1500-1600 kWh/m<sup>2</sup>/ year.

Experiments have resulted in providing a water flow of about 0.5 l/min, which comparing to the pump flow, rate is 5 %. This is mainly due to low voltage, supplied by the solar panel, so future research direction will be considered using the same pump power with voltage of 7.5 V.

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## ROMANIAN SPACE CLEANING PROBLEM IN MORAL AND ENVIRONMENTAL AT THE EDGE OF POSTCIVILIZATION

A. LAZĂR\*

C.LAZĂR\*\*

**Abstract:** *The paper presents clean definition in the Romanian cultural space. Moral and environmental causality crisis of the Romanian space, in terms of ethnographic, scientific and religious. Finding solutions to mitigate the phenomenon, which can be applied taking into account to local cultural and spiritual peculiarities of the Romanian people*

**Keywords:** *moral and environmental crisis, ethnologic, religious and scientific view.*

### 1. Introduction

"Nature appears as a means by which man grows spiritually and realize their intentions towards himself and to others, when maintained and used in accordance with itself, but when men sterilizes, poisons and abuses it in huge proportions, he hinders his spiritual growth as well as the growth others. This confirms the fact that nature is given as a necessary means for human development in solidarity, that is a personal gift of a superior being who created it, as It created people, in solidarity. "(Pr.D. Stăniloae )

Nature appears as a connotation or an organic derivative of space and this problem of space is a specific problem of the modern era. One could say that this is a dominant character. Over time two visions caught shape, the philosophical one, where we recall the Kantian view and the one of Einstein, but also a humanist view, where scientists did find a problem and philosophers did not.

Thus the object of my work will synthesize a vision that includes an interdisciplinary point of view, located on the border of several fields of science, but keeping unaltered the connotation and personal character of each of them and in the same time defining each of them. More accurately, in the current situation, where most solutions regarding environmental crisis are global, my work covers the particular issue and aims to

capture the particular attribute of the Romanian popular belief, considering three coordinates: anthropology, religion and science.

### 2. Sacred and Profane spaces

Looking back at ethnology and cultural philosophy in authors like Frobenius and Spengler there is the opinion regarding the environment that generates culture. They bring their allegations to the front through a theory that states that culture is the result of a particular way of thinking the space/ the environment, which, in the end becomes a symbol. Following this path, we then may say that space becomes a determinant of culture; moreover, the space will become an indispensable mode of expression, for a specific space can only express itself by a symbol space. Thus we encounter the report generated by the sacred / profane duality, where the concept of space and its evolution in the modern society is faced up against primitive thinking society. (Emil Durkheim and Levy Bruhl)

In this context the vision and philosophy or Mircea Eliade with his Sacred and Profane will impose his view. Lucian Blaga is the one that brings up for discussion this very problem within his work The Trilogy of Culture where he claims that the Romanian specific spatial vision identifies with that

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corrugated infinite space called „mioritic” or aboriginal.

Space, seen in the perspective of anthropology, is under the direct touch of the two main frameworks, namely popular mythology and science. If when we talk about mythology we are particularly referring to the interpretation of world and life, popular science will include in its structure, a multitude of closely related knowledge of life, with a strong positive and significant practical consequences (E. Bernea ).

Thus space, how it is presented, is primarily a practical problem, generated by the environment. Neglecting this interdependency unquestionably generates a defining issue, getting to the very core of the physical existence. Space becomes a fundamental framework on which a vision of life rises (E. Bernea) and within this vision, reporting to the Divine in an unavoidable must.

Space as a concept was the subject of both science or philosophy but it can also be found in the anthropological vision, vision on which i would like to reflect more upon. If the first two, the space is an abstract ethnological point of view, the vision translates into a space that becomes a concrete reality, well defined, how E. Bernea called it.

Worth mentioning is that that this type of space is something full of life, a consequence or a result of a natural and normal human existence and what is very important, it cannot remain insensitive or neutral in this balance with space. Moreover, the balance individual/space is not governed only by material coordinates but also by spiritual values that are meant to shape the portrait of this interdependency.

From an ethnological point of view when we talk about space (place), we mention not only the material side of it, but also the spiritual connotation, that is the active-specific one. This is because space has in its structure attributes that give it the right qualities to become what ethnologists and ethnographers like to call, an attitude towards the surrounding reality.

### 3. Romanian Space Cleaning

The size of space represented in the analytical thinking, become involuntary, I would say normally, natural, ethnographic qualitative characteristics space. Or in terms of quality appearance, we strongly believe in aspects of the spiritual connection with space, where preservation and conservation are major objectives, and a part of the elements that together contribute to this goal is cleaning also. The question that naturally arises is whether the current conditions of a global environmental crisis, in conjunction with what experts call a redefinition of the vision of the man/nature ratio within the anthropological vision, complemented by the religious and scientific visions can be a remedy and a variant solution to this problem that bothers humanity. Another question is regarding the degree of capability of Romanian specific vision to be a viable solution in the context of achieving the EU. In this respect, the need of each nation to choose its own cleaning method of space, I find the most relevant, because the knowledge gained from previous experiences can be best adapted to the current situation. In this context, the use of the intangible cultural immaterial heritage of the Romanian people appears as an auspicious perspective, relevant and viable in finding better solutions to improve the problem.

Turning towards cleaning – as a concept, not an action, we can say strongly that we are faced with a in-depth crisis since lack of cleanliness can be detected as a constant defining the Romanian space.

Trying, a short definition of the concept of cleaning, we can frame it within the structure of the well known Triodion bodily-spiritual-and-of space. Keeping this direction and these three features in mind justifies the presence of the religious side since religion is the place that preserves the soul.

Looking in depth at cleaning and taking into account the phenomenon of its presence, one can distinguish between two types, namely the physical and spiritual cleaning. The

physical cleaning refers to issues namely as waste, pollution factors of the atmosphere, soil, water, and not least of bio-fuels.

Speaking of spiritual cleaning, I remind all the factors that are a direct threat to it: the visual pollution, namely, through advertising, its pornographic connotation without forgetting to acknowledge that pornography is seen as a extremely harmful scourge in the world (V. Gheorghiu). I remind then, the second factor, namely the one related to the osmotic side of culture – noise pollution. To all mentioned above we can add two factors, two more types of pollution, more subtle, namely lack of decent clothing and the promotion of false ideals. I support that rethinking the visions regarding the man / nature ration, or what is called the second Renaissance, by researchers of this phenomenon, by returning to Romanian folk beliefs, taking into account the meanings of the dualism of sacred / profane ratio, can be a pertinent solution, even more as I take into consideration only one aspect, namely that of the purification practices that exist within the Romanian geographical space. Another model for reconsideration, could be the concept that emerged after 1990, namely that of ecosofia.

Ecosofia - by Thomas George Maiorescu - is "a system of thinking, a way of looking at, of reading, of living and of understanding the world." "If ecology is the science of relations between the living and the non-living (namely the dead) in an ecosystem and the relationships between ecosystems, especially leaning on man-nature relationship, Ecosofia / oikos = home, housing, household, sophia = wisdom / discipline will be about the wisdom of life in the home. That is the wisdom of human relations within the family, with others, with nature, with the universe, with the self. Thus Ecosofia becomes a synthesis of the five ways of teaching. They also talk about „new” values in the Romanian ecosofia. A new anthropology of self-made by acting directly on the conscience of change with the purpose of shifting its priority (transpersonal

techniques appear to broaden states of consciousness, transformation of the psyche, etc..) will necessarily change individual attitudes and social behavior, raising humanity itself at a higher level of spirituality of humanity reintegrated from a cultural point of view into "home" them in nature and the Cosmos. Ecosofia seeks to create within the individual, to find the answers to fundamental questions of viable existence"

To all this I would add that the religion's role is not negligible. Considering the fact that it is included in its structure, it can change the mentality regarding the environment, whether we talk about a reiteration talk of elements of pagan deceit, of animist deceit, or of an infusion of elements of Eastern religions, or a "green / greening" of patriarchal religions, religion began to play an important role in the search for lasting solutions to the environmental crisis.

#### 4. Conclusions

The need for environmental ethics is based on a real environmental crisis: "In a time of drastic environmental changes such as global warming, species extinction and habitat destruction, there is an urgent need to adopt an environmental ethic, a man-nature relationship, which will lead to the maintenance (the sustainability) of land and its inhabitants".

In this context the "necessities" of environmental ethics, Snyder states the following: "At the root of the problem where our civilization fails stands the mistaken belief that nature is something less authentic (Less than authentic), that nature is not as lively as man, or not as smart, that in a sense nature is dead, and that animals have such a low degree of intelligence and sensitivity, that it should not consider their feelings ... If we are on edge of post-civilization (after-civilization), then our next step should be to take into account the primitive world view, which traditionally and intelligently tried to open and maintain open lines of

communication with the forces of nature ... interest in the Romanian ethnos.  
view of looking back with more and more

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# USING ARTIFICIAL COLD FOR DRYING VEGETABLE PRODUCTS AT LOW TEMPERATURES

ALEXE NICOLAE ORMENIȘAN\*

**Abstract:** *One of the preservation and conservation methods of plant food products is drying. Dried or dehydrated products have a low specific mass, high energy value and is easily handled, transported or stored. Besides water, vegetable products contain vitamins, minerals and essential oils which give them their aroma and taste. As water vaporizing temperature is higher than the volatile oils, using conventional methods of drying, you can lose valuable fractions of flavouring substances. Also a quick drying, breaks a part of life processes, but leaves the colour and prevents micro-activity that would lead to their alteration. The drying method proposed in this paper is aiming to create a facility that allows quick drying and low temperature without destroying the plant tissue products so that they retain as much of the original qualities.*

**Keywords:** *dry, cold, vegetable products.*

## 1. Generalities

Drying is a process that involves the partial removal of one phase of a mixture liquid-liquid or liquid phase from a solid-liquid mixture until it reaches a steady state. Drying can be:

- *natural*, as a result of the action of atmospheric factors (solar radiation, temperature, humidity, pressure, etc.);
- *artificial* - a process that takes place under the action of predisposing factors, artificially created for this purpose (heat, dehumidifiers, absorbent substances, vacuum, vibration, high frequency, microwave, etc.).

Both natural and artificial drying, are improved and favored by the existence of currents of air that can be:

- natural, due to differences of barometric pressure and temperature;
- convection due to differences in specific weight of air layers which have different temperatures;
- artificial, generated by means of fans.

Natural or artificial drying processes have much in common and therefore most artificial drying methods used are based on the principles of natural drying but an essential difference between the two methods is that if artificial drying, the drying process parameters can be controlled. Also, drying time is very different. Thus, in case of natural drying time may arrive a few days - and the process is dependent on meteorological

factors, where artificial drying time can be controlled and reduced to a few hours.

## 2. Determinants of the drying process

Some of the most important factors influencing the drying process and which can be easily generated and controlled are: humidity, temperature, speed and direction that air currents.

### 2.1 Humidity

The main purpose of drying, humidity is lower, up to the balance. This can be achieved by removing water from the outer layers initially, followed by water migration from inside to outside. At steady state is reached, the drying process stops. Removal of surface water can be achieved by:

- evaporation;
- use of hygroscopic substances.

Surface water may vaporize if the ambient air is unsaturated moisture or water vapor pressure is greater than the absolute pressure. Drying can continue if the state of imbalance remains which is achieved by removing moisture from the outer surface or layer saturated limit by:

- heating;
- ventilation;
- condensation of water vapor and removed from the system so that the atmosphere remains unsaturated in humidity.

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## 2.2 Temperature

It is the most important parameter of a drying process. Drying with heat is based on the vaporization of water is favored by increasing temperature and that warm air can hold a larger quantity of water than cold air (see moisture balance).

Products subject to drying temperature increase, resulting from the transfer of heat from a source to them. Heat transfer can be achieved by:

- radiation;
- conduction;
- convection.

Other methods of increasing the temperature used in the drying process are:

- vibration;

- high frequency;
- microwave.

## 2.3 Pressure

As can be seen in the triple point diagram of water, respectively vaporizing water vapor transition can be achieved at any temperature in the range 0-374°C. Thus, for a given pressure to pass the limit of saturation represented by OT- curve, respectively TC-, by increasing temperature, water vaporizes. Also from the triple point diagram of water it can be seen that for a certain temperature, evaporation process can be accomplished by lowering the pressure below the saturation,

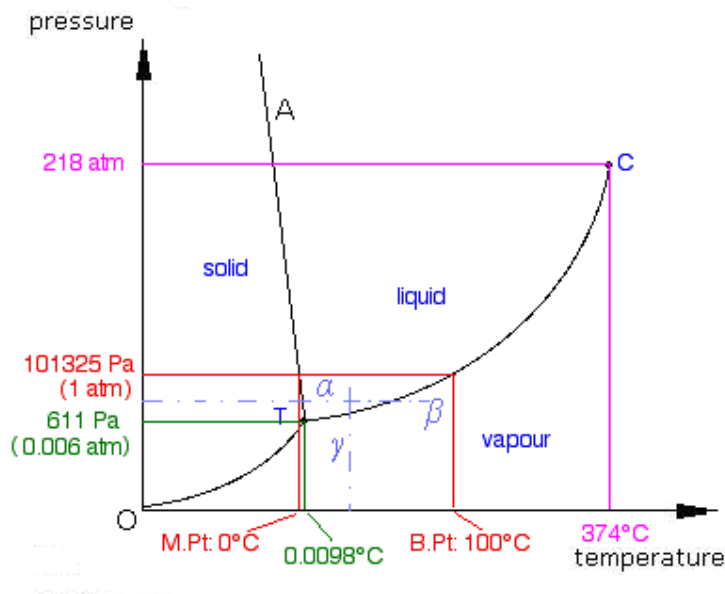


Fig.1. Triple point of water

## 2.4. Ventilation

It is an important determinant of the drying process, it contributes to heat and maintain the temperature at the required parameters by forced convection.

By ventilation, it allows cooled air and supra-saturated in humidity from the boundary layer to be replaced with hot, subsaturated, dry air. By proper directing air flows using deflectors, it ensures uniform drying of the entire volume of desiccated product. Also, moist air, directed to certain areas or cold surfaces, can lose moisture through

condensation and it can be returned to the drying circuit without losing heat gained.

Generally, the vast majority of dryers work on the principle of convection, the drying agent being the heated air. It effectively transfers heat absorbing material to be dried and release water vapor. Water vapor absorption results due to the fact that warm air can hold a larger amount of water vapor than cool air.

Drying is a complex thermodynamic phenomenon, linked to high energy consumption as heat. Therefore, when we must choose between two equivalent systems, heat consumption is decisive, if other



elements not involved in a possible economic calculation. Obtain high thermodynamic and economical performances is based usually on heat recovery contained in the heat agent by re-circulating, using heat exchangers, recuperators, etc.

Whatever the method chosen, heat generation and transfer involve the largest energy consumption. Therefore, researches in this area are mainly directed to find ways and methods to reduce time and energy consumption for drying.

**3. Overall heat balance of a dryer**

Formulate the underlying heat balance is given by the first principle of thermodynamics, which in this case may have the following forms: the steady, the amount energy that enters a system is the sum of energy coming out of that system.

Generally, considering the dryer as a thermodynamic system, heat balance equation is given by:

$$\sum Q_I + \sum L_A = \sum Q_E + \sum Q_P \quad (3.1)$$

where,  $\sum Q_I$  is the sum of heat quantities that enter in the dryer and it is given by the relation:

$$\sum Q_I = Q_{mi} + Q_{ii} + Q_{ai} \quad (3.2)$$

where,  $Q_{mi}$  is the heat quantity that enters together with dry material;

$Q_{ii}$  - heat quantity given by the heating system;  
 $Q_{ai}$  - heat quantity that enters together with exterior air.

$\sum L_A$  is sum of heat quantities equivalent to mechanical work done by drives systems:

$$\sum L_A = L_v + L_t \quad (3.3)$$

Where,  $L_v$  thermal equivalent of mechanical work consumed by the ventilation system;

$L_t$  thermal equivalent of mechanical work consumed by transport system, handling, etc.

$\sum Q_E$  is the amount of heat discharged from the dryer:

$$\sum Q_E = Q_{me} + Q_{ae} \quad (3.4)$$

where,  $Q_{me}$  is the amount of heat that comes with dry material;

$Q_{ae}$  - the amount of heat that comes loaded with heated air and humidity

$\sum Q_P$  - is the amount of heat discharged from the dryer through the floor, side walls and ceiling, due to the thermal losses through isolation:

$$\sum Q_P = Q_{pd} + Q_{pp} + Q_{pt} \quad (3.5)$$

where,  $Q_{pd}$  is the heat quantity lost through the floor;

$Q_{pp}$  - the heat quantity lost through side walls;

$Q_{pt}$  - the heat quantity lost through the ceiling.

Schematically, the energy balance of a dryer can be represented as in fig.3.1

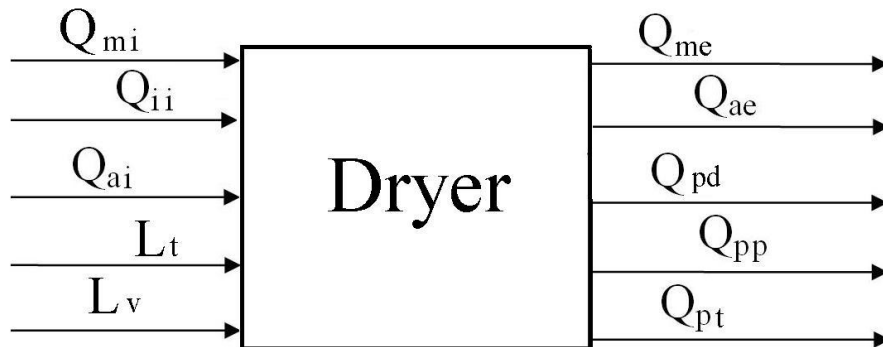


Fig.3.1 Energy balance of a dryer

Reducing operating expenses and therefore energy consumption is an objective need for dryers users and a target for the

researchers in the field. The most accessible and popular methods used in this sense, comes from the analysis

of equation 3.1 in terms of its expanded form

which

is:

$$Q_{mi} + Q_{ii} + Q_{ai} + L_v + L_t = Q_{me} + Q_{ae} + Q_{pd} + Q_{pp} + Q_{pt} \quad (3.6)$$

In most dryers, reducing energy consumption includes:

- recovering part of the energy consumed and discharged with dry material and moist air;
- reducing heat loss through walls, ceilings and floors.

The use of additional heat exchangers allows recovery of part of the energy evacuated, represented by terms  $Q_{me}$  and  $Q_{ae}$  and reintroducing heat to the dryer. This can be achieved by preheating of items for dry or outside air, using heat recovery exchangers. Thus, increasing terms  $Q_{mi}$ ,  $Q_{ai}$  respectively  $\Sigma Q_i$ , sum of heat quantities that enters in the dryer.

By increasing the quality of materials used in isolating ceiling, side

walls and floors, it reduce a part of energy corresponding to terms  $Q_{pd}$ ,  $Q_{pp}$  and  $Q_{pt}$  from the relation 3.5.

Thus, considering the terms  $L_v$  and  $L_t$  from relation 3.3 as constant, it results that for maintaining the equality from relation 3.6, must decrease the term  $Q_{ii}$ , as logical conclusion.

#### 4. Thermodynamic characteristics of wet air

The drying process, removing water presumes bringing it into vapor. Water absorbs a lot of energy, required by transforming it into vapor. Table 1 presents the values of the latent heat of vaporization of water (saturated vapor), for different values of temperature and pressure.

*Thermodynamic parameters of water at different temperatures*

Table 1

Temperature [t °C]	Absolute pressure [x10 <sup>5</sup> Pa] (mmHg)	Enthalpy of liquid phase at saturation i [kJ/kg] (kcal/kg)	Enthalpy of dry saturated vapors, i'' [kJ/kg]	Latent heat of vaporisation, c = i'' - i' [kJ/kg] (kwh/kg)
20	0,023(17,528)	83,90 (20,04)	2537,201	2453,465 (0,681)
40	0,073 (55,314)	167,89 (40,01)	2573,626	2406,154 (0,668)
50	0,123 (95,518)	209,298(49,99)	2591,629	2382,289 (0,661)
60	0,199(149,39)	251,1243 (59,98)	2609,214	2358 (0,655)
70	0,311(233,76)	292,9923 (69,98)	2626,38	2333,304 (0,648)

For vaporization of water it consumes a significant amount of condensation heat but it can be largely recovered and reintroduced into the system. For this, we need a system for condensation of water vapor present in moist air resulting from the drying process.

Water vapor from the air can be condensed if the temperature of the mixture drops below the

dew point. Dew point corresponds to the saturation state of the mixture and it can be achieved if the air comes in contact with a cold surface. The main characteristics of saturated humid air absolute pressure of 10<sup>5</sup> Pa are shown in Table 2.

*Thermodynamic parameters of humid air at different temperatures*

Table 2

Dew point [t <sub>r</sub> °C]	Concentration of vapor of water [g/m <sup>3</sup> ]	Specific enthalpy [kJ/kg]	Dew point [t <sub>r</sub> °C]	Concentration of vapors of water	Specific enthalpy [kJ/kg]
0	4,845	9,56	40	51,04	167,8
4	6,356	16,81	50	82,72	277,3
10	9,391	29,52	60	129,56	464,6
20	17,27	57,88	70	196,8	811,3

Analyzing the data in Tables 1 or 2, relative to a specific reference temperature drying process can draw the following conclusions:

- Temperature can directly influence the drying process, because with its increasing concentration of water vapor saturated limit corresponding increase greatly. Otherwise said, warm air can absorb more moisture than cold air only
- Vaporization of water requires high energy consumption, according to the latent heat, which if possible should be recovered.
- Specific enthalpy of humid air at saturation increase exponentially.

Vapor heat recovery can be a source of renewable energy even during the drying process. To this end, the flow of warm air laden with moisture, proper temperature must be cooled to the dew point. Thus, evaporation latent heat can be recovered by condensation.

Therefore, moist air must pass through a heat exchanger with the temperature below its dew point where water vapor to condense and form liquid water that can be removed from the system.

### 5. Drying moisture condensation

The diagram in figure 3.2 is a schematic diagram of a dry to specific elements of a traditional dryer (heat source, fans, baffles, isolation, walls, etc.), including a refrigerator.

According to the paradox of refrigeration, if introducing a refrigerator running in a thermal isolated inside, and then the temperature inside the chamber will increase. This is because any refrigerator produces more heat than cold.

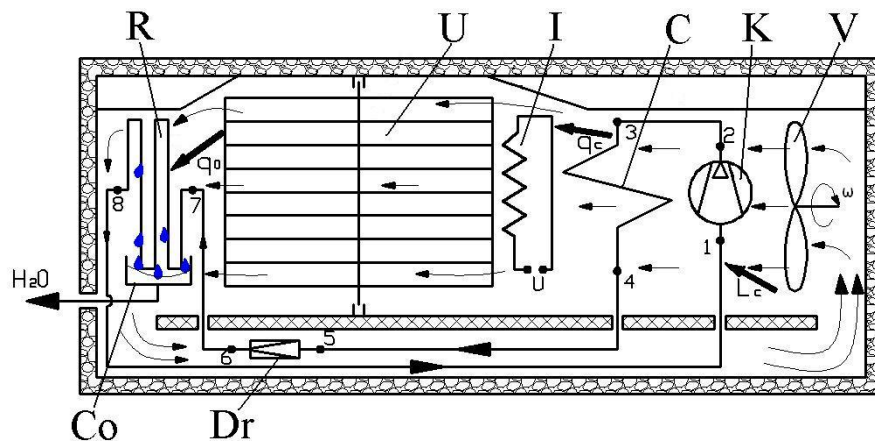


Fig.3.2 Dryer refrigerator for condensing

Refrigerator with mechanical vapor compression consists of compressor K, driven by an electric engine, the capacitor C, rolling valve Dr, evaporator cooler R and lines connecting.

Desiccated product with initial moisture level degree  $X_i$  is placed on the support U. The air for drying, heat at the beginning by the heat source I, to maximum admissible temperature  $T_u$ , is conducted with help of the ventilator V to the drying product. After the air absorbs a certain quantity of moisture  $Ue_i$ , in theory to the saturation limit, it is passed through the evaporator cooler R. This has a temperature  $T_r$ , under the dew point of humid air and air vapors could condense on the cooler surface. Condensation drops runs on cooler surface by gravity, is taken by the collector  $C_o$  and removed from the dryer. After passing the cooler, the air has the following parameters:

- Temperature  $T_r$ ,  $T_r < T_a < T_u$  ;
- Humidity  $X_r$ ,  $X_r < X_i$  ;

After that, the air dried and cooled, it takes the heat from the ventilator's engine V, from the compressor K and the electric engine, cooling them. Also, it cools and takes a quantity of heat from the capacitor C that results from refrigerant condensation. Thus, behind the heat source I, the air is dry, having the humidity  $X_r$ , under the saturation limit and preheated to the temperature  $T_c$ ,  $T_c < T_u$ . After that, the air is re-heated by the source I, and takes only the necessary amount of heat to cover the difference  $\Delta T_i$ ,  $\Delta T_i = T_c - T_u$ . By re-heating it has to cover a much smaller amount of heat than the original. Being heated and dried much more under the saturation limit, it can absorb a bigger amount of moisture. In additional, as cold air is going near the floor it has a low temperature, loss of heat through the

floor  $Q_{pd}$  (rel. 3.5) decrease or can become null. If the floor temperature is higher,  $Q_{pd}$  can have negative values. A very important aspect is that, if we want to keep the drying speed, we can decrease the heating temperature  $T_u$  to a smaller value than in case of the classical dryers. This is of special importance because at temperatures above 50°C, the active enzymes and flavoring substances that are volatile oils, neutralized or lost by evaporation.

## 6. Conclusions

Drying is the most simple, common and relatively inexpensive method of preservation of vegetable products. Initial investment and high cost of energy consumed in the drying process, determines also expensive in the production of dried vegetables (vegetables, fruits, herbs).

The quality of finished products, the active substance and the benefits are significantly influenced by the correct choice of drying regime. Conventional low temperature drying is in the range 30...50°C, is recommended to protect the active components sensitive to high temperatures (flavors, vitamins, color). However, studying literature and comparing different species and varieties of crops were found in the drying regime can not be made general recommendations and that each type of species must be investigated individually. In addition, different types of dryers are suitable for different specific parts of plants, such as roots, leaves, flowers, fruits, or seeds.

Special emphasis should be on the correct choice of drying temperature, because of its major influence on economic and operational parameters such as the drying capacity, energy consumption and quality requirements of the finished product.

Low temperature drying process reduces dryer's capacity. Therefore, the main focus of

research in drying plant products is to find optimum drying temperature for different species of crops, keeping quality parameters and operating costs of dryers. Despite all the technical and technological developments, the correct choice of drying temperature remains the most important criterion both economically and environmentally. The recommended values in the literature and used in practice, are often far from each other, which seems to confirm that there is an urgent need for research in this area.

Whatever the type of installation, to increase dryers performance, it has to pass over a paradox. warm and dry air production is able to absorb much more moisture.

To reduce consumption of energy from fossil fuels, CO<sub>2</sub> emissions and decreasing greenhouse effect - responsible among other things, for the phenomenon of global warming - some measures should be adopted to limit consumption energy, concerning using and operating of driers.

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# ENERGY RECOVERY FROM WASTE WATER USING HEAT PUMPS

ALEXE NICOLAE ORMENIŞAN\*

**Abstract:** Sewage, waste or water channel, is the result of daily activities in many fields: domestic, food, commercial, tourist and industrial. Water temperature in the network is in the range 7 ... 15°C and average temperature of wastewater or sewage, is about 20°C. This difference of 5...13°C, at a relatively high rate, may represent a potential source of renewable energy that is normally lost, being discharged into sewers. One of the methods of energy recovery from wastewater is the use of heat pumps.

**Keywords:** heat pump, energy, sewage water.

## 1. Generalities

Thermal energy from existing energy and stored in the environment, is a process known since ancient times. Any signal the start of an economic crisis or energy, leads to emulation among researchers to search for and find new energy sources, means and efficient methods and high efficiency for the production or recovery.

The price of conventional energy grows continuously and the evolving environmental requirements, requires the use of thermal plant yields increasingly higher and a lower impact factor as relative to pollution and global warming phenomenon. Therefore, the use of operating

procedures of any kind of energy is more than justified.

Classical methods of reducing energy consumption is found to increase housing walls to improve insulation, cold stores and buildings in general, use of electrical appliances and economic household etc.. - leading to operating costs as low as possible.

## 2. Heat pump

Heat pumps are installations which take the form of heat energy from a natural source and a residual or transported or "pump" to a consumer. Suggestive of heat pump operation is shown in Figure 1.

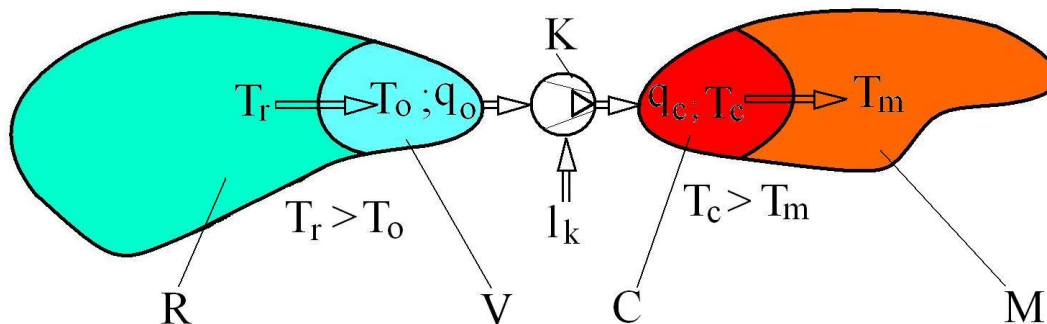


Fig. 1. Heat transfer through a heat pump: R residual heat source, V-evaporator heat exchanger, C- condenser heat exchanger -, M - environment to be heated

$T_r$  is the temperature of the residual heat source R,  $T_m$  is the environment M to be heated temperature. Between temperatures of the two environments is the relation,  $T_r < T_m$ . Paradoxically the operation of heat

pumps that they can transport heat from the waste source with lower temperature  $T_r$ , to the environment to be heated which has higher temperature  $T_m$ , without contradicting the second principle of

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thermodynamics , which in *Rudolf Clausius* formulation (1850 ) is:

*Heat can not pass naturally from the body with low temperature, to a high-temperature one.*

Heat is taken from the source R through a heat exchanger and is transferred to the consumer M, with another heat exchanger. Handing or ceding heat with heat exchangers, is based on the following temperature differences:

$\Delta T_i = T_r - T_0$  initial difference between temperature  $T_r$  of the residual source that gives off heat source and temperature  $T_0$  which takes the heat of the first heat exchanger;

$\Delta T_f = T_c - T_m$  the final difference between the temperature  $T_c$  of the second heat exchanger which gives the heat and the temperature  $T_m$  of the environment to be heated, that takes the heat.

Heat transport is achieved by using of compressor K through a thermal agent, which has specific physical properties. As with refrigeration, fluid (thermal agent), transporting heat between two heat exchangers, is a refrigerant.

Operation of heat pumps is based on the following principles:

- reversed Carnot cycle, or the cold cycle;
- reverse operation of the refrigerator;
- the refrigerator paradox.

Completion of a reversed Carnot cycle is achieved with minimum possible energy consumption. It is a reversible cycle, called the ideal refrigeration cycle and takes place in wet steam, as seen in the diagrams in Figure 2.

Working process takes place on the line  $0-T$ , between cold source temperature  $T_0$  theoretically equal with vaporization temperature of thermal agent,  $T_v$  and hot source temperature  $T_k$  theoretically equal to the condensation temperature,  $T_c$ . For heat pumps,  $T_0 = T_r$ . On abscissa  $0-S$ , the process is between the two reversible adiabatic ( $S = \text{constant}$ ): compression 1-2, respectively relaxation 3-4, sense of the cycle scroll backwards or counterclockwise. As shown in Figure 2  $T-S$  diagram, specific heat quantity  $q_0$  is taken from the waste heat source having a temperature  $T_0$  through a heat (cold) agent, transported and transmitted, but in a quantity  $q_c > q_0$  at a temperature  $T_c > T_0$ , to the environment to be heated.

Additional amount of heat and higher temperature is due to mechanical work consumed in the compression process of refrigeration compressor.

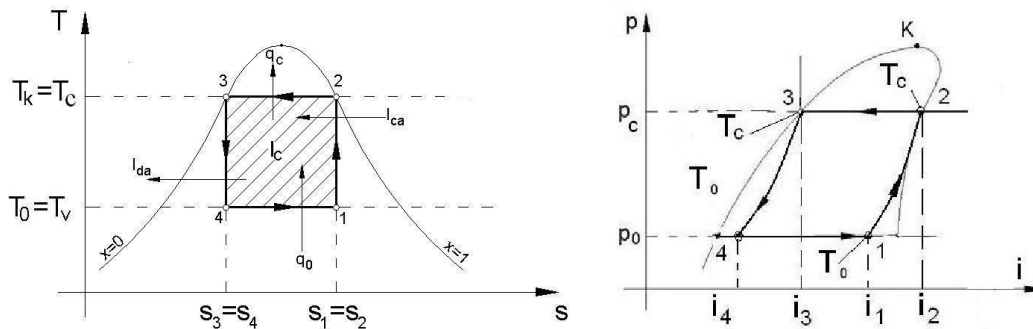


Fig.2. Reversed Carnot reversible in wet steam

Thus, any refrigerator that works as a *Carnot* cycle reversed, can be used as a heat pump.

Consider a refrigerator (domestic) located in a closed, perfect isolated thermally (adiabatic) site. If the cooling compartment door is open the temperature inside will increase. This is because *any refrigerator produces more heat than cold*. It may be called "refrigerator paradox", confirmed by heat pumps operation.

This can be written with the overall energy balance equation of a mechanical refrigeration vapor compression:

$$q_{cm} = q_{om} - l_{cm}$$

where,

$q_{om}$  is amount of mass specific heat taken from the environment to be cooled;

$q_{cm}$  - specific amount of heat transferred the outside environment;

$l_{cm}$  - specific mass mechanical work consumed by the compressor.

### 2.1. Water-water heat pump

Depending on the source from which the pump takes heat, they can be:

- sun - water if the heat source is solar energy;

- air - water if source heat is the air in the surroundings or gas;
- water - water if the heat source is water rivers, lakes, seas, oceans, the ground water or geothermal water;
- water - ground, if ground source heat.

Of these, the most performance heat pump is water - water as heat exchange between two fluids is achieved with high efficiency. Scheme design of a heat pump is shown in Figure 3.

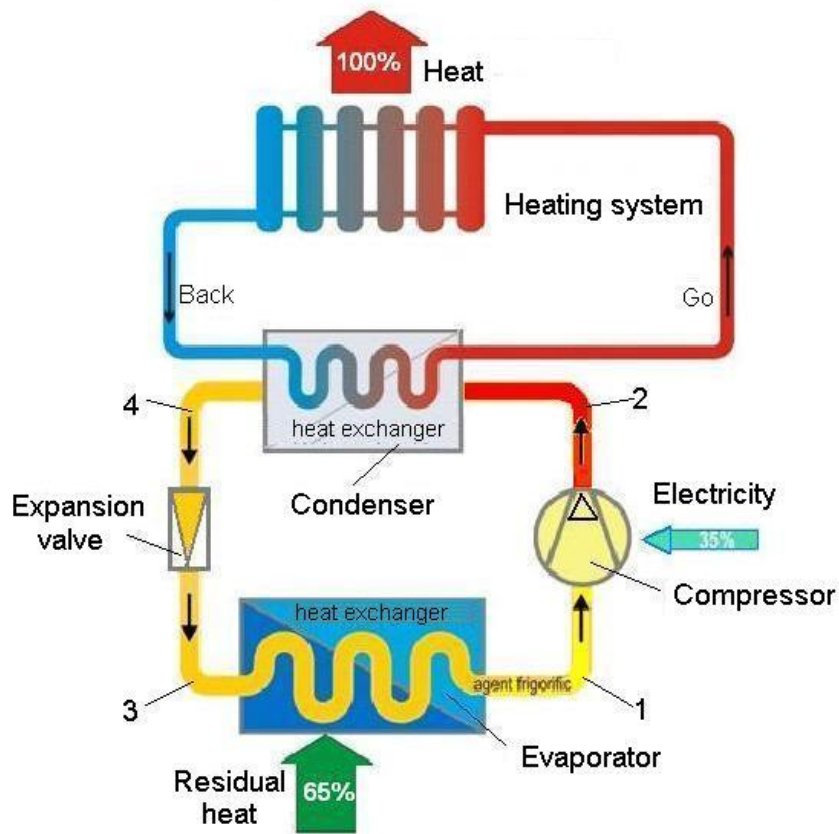


Fig. 3. Scheme design of heat pump

Heat is taken from source using the residual heat exchanger - evaporator V. This is because the temperature  $T_0$  of the refrigerant vapor is always less than the residual source temperature  $T_r$  ( $T_r > T_0$ ). The refrigerant vaporized and heated, is taken over the compressor K. It is compressed, in the adiabatic theory (actually polytrope) to pressure  $p_k$ , which leads to warming of temperature  $T_c$ . Reached in the heat exchanger - condenser C, the refrigerant condenses and

gives heat of condensation to thermal agent from the heating system. Heat transfer occurs because the condensation temperature  $T_c$  is always higher than the temperature  $T_m$  of the thermal agent from the heating system ( $T_c > T_m$ ). Thus, the energy intake of the compressor, heat from the residual source, gets the heating system. If the distance from the evaporator to residual source is high, it can use an intermediate takeover circuit and transfer of heat from the source to the evaporator.

Heat pumps, utilizes the freon refrigerant R407C, because it has a low global warming potential  $GWP = 0,38$ . Common values of parameters in different points of refrigerant heat pumps are:

- Minimum cooling agent temperature at the evaporator input,  $T_{o4}$ ,  $-15...-2^{\circ}\text{C}$ ;
- Maximum cooling agent temperature at the evaporator output,  $T_{o1}$ ,  $0...+5^{\circ}\text{C}$ ;
- Minimum cooling agent temperature at the condenser input,  $T_{c2}$ ,  $+35...+50^{\circ}\text{C}$ ;
- Maximum cooling agent temperature at the condenser output,  $T_{c4}$ ,  $+30...+48^{\circ}\text{C}$ ;

The analysis of temperature ranges presented, shows that heat pumps can be used for heating systems with relatively low temperatures, e.g. for under floor heating or for the first stage of a heating system.

## 2.2. Coefficient of performance

Water-water heat pumps, use energy stored to water rivers, lakes, seas and oceans, water from groundwater or geothermal. In addition, must be taken into consideration waste waters and drainage because they store themselves a large amount of energy that is currently unused.

For qualitative assessment of functional parameters of heat pumps, it can use the coefficient of performance,  $COP$ . This is the ratio between the amount of heating energy

delivered and the amount of energy consumed by the compressor, or using the terms from relationship 1,

$$COP = \frac{q_{cm}}{l_{cm}} \quad (2)$$

Of all types, currently pumps heat water - water is the most effective, with a coefficient of performance  $COP$  between 5.5 and 6.1. Results that for a consumption of 1kWh from the electricity network, theoretically, can occur with heat pump 5.5 ... 6.1 kWh thermal energy. Taking into account the heat transfer efficiency,  $COP$  has real value in the range 3 ... 5.

Increase the value of the coefficient of performance, involves the following:

- increasing heat source temperature to values  $0...15^{\circ}\text{C}$ ;
- decrease heating system temperature to values between  $35...50^{\circ}\text{C}$ ;
- increasing efficiency of energy consumers (motors, compressors, pumps).

In Figure 4, is presented the dependence of  $COP$  by the difference  $\Delta T = T_m - T_r$  between heating system temperature  $T_m$  and the temperature  $T_r$  of residual source.

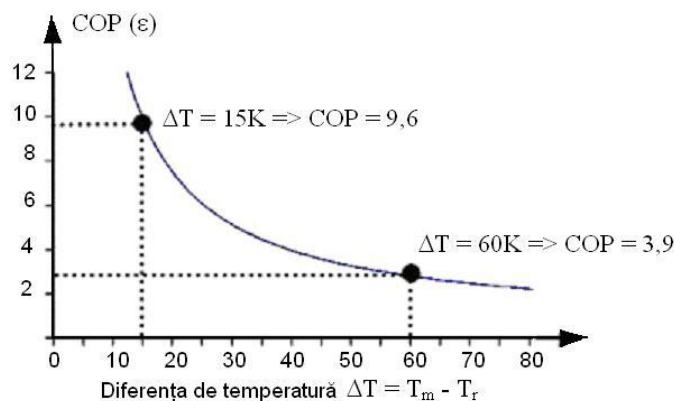


Fig. 4.  $COP$  evolution according to  $\Delta T = T_m - T_r$



### 3. Using waste water as heat source

An important factor to be considered carefully, is the amount, composition and quality of waste water we have available as a source for heat. According to EU statistics, the average water consumption per capita is 3.5 m<sup>3</sup>, of which about one third is domestic hot water. Considering that cold water has an initial temperature of 10 °C and hot water is heated to 50 °C and the ratio hot / cold water is 1/3, shows that average temperature of wastewater is

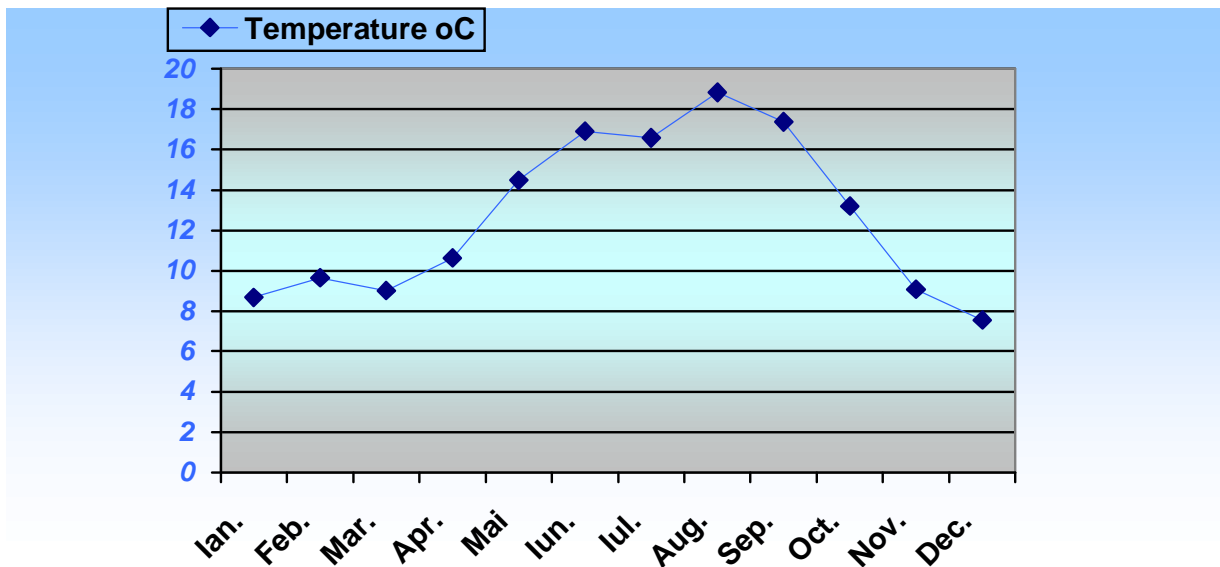
around 23 °C. In general, in case of wastewater or sewage, temperature at the exit of the source is,  $T_r = 15 \dots 25$  °C. This value is variable, being dependent on several factors: the building destination, type of activity taking place inside, personnel structure, time of year, outside temperature etc.. For example, Table 1 shows the evolution of control parameters of wastewater during 2011, the Water Company treatment plant Brasov.

### VALUES OF THE MEAN QUALITATIVE INDICATORS AT THE WATER TREATMENT PLANT BRAȘOV

Table 1

Indicators (monthly average) Temperature °C	Ian.	Feb.	Mar.	Apr.	Mai	Iun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature °C	8.97	9.64	9.01	10.63	14.48	16.91	16.58	18.84	17.38	13.2	9.07	7.55
CCO-Cr, mg/l	168.73	158.21	160.41	162.85	161.84	146.20	103.90	117.93	158.08	166.62	161.30	158.30
CBO5, mg/l	66.10	59.34	57.89	55.94	56.01	53.38	37.35	42.24	56.75	66.65	67.90	66.10
NH4, mg/l	21.1	21.13	28.21	22.1	27.32	27.46	19.67	18.54	19.1	22.64	22.7	22.7
PT, mg/l	1.92	2.04	1.92	1.96	2.35	2.02	1.57	1.55	2.14	2.31	2.40	2.20
MTS, mg/l	69.69	59.33	76.08	81.51	88.09	84.00	70.17	17.41	144.00	68.96	70.20	71.20
R.filtr.105 C	450.7	466.0	408.48	403.53	416.90	396.80	382.50	105.16	393.77	401.36	402.80	450.00

Temperature (average values ) evolution diagram for the year 2011



As shown in Table 1, sewerage and waste waters reach to the treatment plant with a temperature ranging between 7.55 and 16,91 °C and 12 months average value is 12.688 °C. Difference up to 15 ... 25 ° C is the heat loss when passing through the sewage system.

Geothermal used water or not used for therapeutic purposes, have temperatures in the range 18 ... 25 °C. These come from resorts, being discharged after use, in the sewage system (Bailer Felix, Băile 1Mai. Herculane, Sovata etc.). They can also be exploited, geothermal sources having temperatures below 20 °C (e.g. Codlea- Braşov resort where spring temperature is 18 ° C throughout the whole year).

#### 4. Conclusions

Heat pumps are a viable solution for energy recovery and use it for heating systems.

Like any refrigerator, in addition to relatively high temperature and heat produced in the condenser, heat pumps produce low temperatures respectively cold. Thus, by changing the direction of movement of fluids and the heat exchangers, heat pumps can be used both as heat and cold.

Waste waters, from sewage system or geothermal waters which have a relatively low temperature, are a potential source of energy, heat pumps exploited. Moreover, their high temperature compared to other heat sources

increases the coefficient of performance of heat pumps.

Due to significant energy savings (50 ... 70% compared with traditional fuel central heating), high reliability, low maintenance costs, and the environmental benefits, heat pumps are widely regarded and used increasingly larger in countries of western Europe and the USA. For example, in Sweden, 9 out of 10 property owners, choose heat pump as heating and cooling systems air conditioning), including for domestic hot water production.

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## PERSPECTIVES OF AGROMACHINE OF TECHNOLOGIES FOR QUALITATIVE CLEANING OF GROWTH WEIGHT

**ZH. S. SADIKOV, SH. A. ALPEISOV**

**Abstract:** *Theoretical, methodological and practical aspects of creation of perspective competitive domestic grain technology are resulted. Results of tests of a unique design of a combine under the conditional name "Kazakstandyk-1", have confirmed economic feasibility of their introduction not only in Republic of Kazakhstan, but also abroad.*

*At the first stage it is necessary to promote creation of co-productions on release of "Kazakstandyk-1" with gradual increase in a share of domestic components in let out "Kazakstandyk-1" to 60-80 percent. Ways further perfection and researches of new resource-saving technology of cleaning of biologically high-grade grain in Kazakhstan are shown.*

**Keywords:** *conference, combine, drum-type smaller grains, biomass, machine-building factories, optical method, agricultural crops, Science Research Works.*

In agricultural production the most of the capital-intensive are mobile machines (tractors, combines, cars) and the stationary equipments for processing of a crop and animal industry complexes. With reference to them the problem of increase of their efficiency always somehow chose, but now it has got a special sharpness. As a business not only in the market economy. In many directions of a technical policy the human has faced a threshold reasonable irreducibility machine and the equipments on dimensional-mass and to cost indexes. For example, for last sixty years the weight of combine harvesters of the most widespread models has increased from 3-3,5 t till 13-15 t (almost at 5 times), capacity of established engines from 50 to 350horse power (at 7 times), throughput about 2-2,5 kg from to 12-14 kg from (six times). The working mass of a combine with refueling and the full bunker makes 18-22 t, and combines of a class of 10-12 kg from to 25 t. From here the big fuel consumption, destroying influence on soil, excessive inclusion with long times of returned of investment. Question - where next to go? Growth single power of cars any more doesn't give due effect [1].

A lot of countries find different ways of exit from this situation though in parallel still continue a dimensional and power tendency

of escalating their machines. But nevertheless the most effective such directions admit: technification manufactures, perfections to recovery machine, introduction of principles of exact agriculture, differentiate decisions with reference to concrete working conditions of reception of agricultural products, cars on the basis of the unified base of cars and their updating, working out of new technologies and ways of influence on agricultural raw materials, intellectualization of cars, increase of operational reliability of techniques.

In many cases these directions give the most notable effect exceeding effect from simple escalating of weight and capacity of machine.

In KazNAU (Kazakh National Agrarian University) together with the largest combine builder factories of Russia develop perspective grain technology and modification seed-rice grain harvests go of a combine of "Kazakstandyk-1" which has taken place the state tests and recommended for release of industrial party. It can form a basis domestic combine builder that coincides from the country offered by the President strategy of reforming of agriculture of Kazakhstan, corresponds to Law Republic of Kazakhstan «About Grain», to the bill «About Seed-growing», and also to

governmental order Republic of Kazakhstan about manufacture in Kazakhstan of combine harvesters and their further realization.

In KazNAU research on theoretical, methodological and practical aspects of creation perspectives competitive domestic of grain technology adapted for specificity local a condition [3-13] proceeds. Results of tests of a unique design seed-rice grain harvest a combine of "Kazakstandyk-1", have confirmed economic feasibility of their introduction not only in Republic of Kazakhstan, but also abroad.

Advantage of a design of harvest techniques of new generation "Kazakstandyk-1" [14]:

- Installation perfection knot doesn't prevent to use effectively a combine on direct services;

- Use of constructional schemes of the serial inclined chamber. The bottom of the inclined chamber serves;

- Sufficient reliability and working capacity constructions;

- The grain which has passed in a zone of the inclined chamber surpasses in quality grain after drum-type smaller grains (micro damage and crushing); high energy of germination; the greatest weight of 1000 grains;

- Maintenance of unloading of a drum to 8,4 % from the general technological weight, and completeness of allocation of grain the punched surface of the inclined chamber, under corresponding conditions, can reach 10 % and more;

- Conditional, expected economic efficiency: from change of quality of the production (wheat "Saratov-29") with application of the modified combine of "Kazakstandyk-1" 670716 tg on annual standard hard can be equal; from change of quantity of production (rice "Cuban") efficiency on annual standard hard can reach 1410000 tg.

- Safety and conformity of the tested knot to requirements occupational safety standards system.

In scientific research institute of agro engineering problems and KazNAU new to

technology the basis of the new theory a biomass is formulated, complex mathematical models under his supervision take root into practice innovative agro technology and the means, making scientific bases of creation of harvesters of new generation. Are received a number of parametrical mathematical models of new working bodies of harvesters.

Introduction of advanced domestic grain technology is supposed to be carried out in following stages: manufacturing and demonstration of new combines in work; the organization of study-educational trainings and seminars in regions and preparation of corresponding experts; distribution of advertising materials and marketing researches. For formation and modernization of machine-building manufactures, release of competitive "Kazakstandyk-1" the big means for purchase of the equipment, the patented technologies and be required. On these purposes the part of means forced industrially-innovative developments which it is necessary to give to factories of mastering "Kazakstandyk-1" - in the form of long-term credits on favorable terms should be directed. At the first stage it is necessary to promote creation in republic of co productions on release of "Kazakstandyk-1" with gradual increase in a share of domestic components in let out "Kazakstandyk-1" to 60-80 percents.

Results of the spent researches and research and developmental works to be used at universities, in design offices of machine-building factories and multipurpose information system in scientific research institute for carrying out of researches on resource-saving technology and the harvest techniques at creation new and perfection of old designs, at institutes of improvement of professional skill. Work will help experts ministry of agriculture to workers of a private sector, small and average business; to the businessmen who are engaged in maintenance of process of cleaning and processing of grain - to improve an agro technology grain manufactures, to improve use of available cars at cleaning seed and

grain crops, to increase an export potential grain and to raise their quality. All it will give the chance to our republic to find the niche in the modern market, to have quality production, to let out it with smaller industrial costs, than at competitors; Who will help those works in sphere of agro business and everything, wishing to familiarize with a modern view on the theory and agricultural mechanical engineering practice in Republic of Kazakhstan.

And new technologies also are conducted in scientific research institute of agro engineering problems research on a theme «Working out of a design of the optical device for optimization of parameters of the agro machine production technology of agricultural production on a minimum of losses» - channelized is proved by that as Kazakhstan is at an agrarian-industrial stage of technological development, the key factors influencing technological development, production efficiency and modernization, speed of development of new kinds of production and attraction of the newest of the production technology are. Gathering of biologically high-grade grain and seeds by more exact recognition of harvest ripeness of agricultural crops promotes a solution of problem maintenance of food safety and can be solved in the presence of effective remedies of mechanization of harvest works which would allow cleaning them on seeds and commodity grain with the least losses and high quality.

Therefore working out of an optical method and the device for recognition of the harvest ripeness of the agricultural crops providing decrease of quantitative and qualitative losses in comparison with analogs on 20-30 % and gathering of biologically high-grade grain providing qualitative foodstuff and the best sowing qualities of seeds, is an actual problem [15].

Manufacture of grain crops has entered that stage when the further expansion of the areas became economically inexpedient. Escalating grain manufacture should be reached at the expense of growth of productivity and decrease in losses at

cleaning. There upon perspective directions Science Research Works in agro engineering branch is the new way of agricultural crops by magnetic processing fresh the threshed seeds for change of its biophysical, biochemical, physical and chemical properties which it will be used in agriculture for seeds of different kinds of agricultural crops at and harvesting.

Perspective direction Science Research Works is working out of a new way seed and grain crops and is constructive-technological scheme of the combine harvester, allowing, realizing magnetic stimulation of grain in process. Authors on the basis of process studying grain and seed cultures the new technological decision with application of magnetic stimulation is offered.

Realization of the results received during executed Science Research Works in the given direction will be allow to increase productivity of grain and seed cultures, and also to cut down expenses on their storage. The offered technical decision has following advantages: simplicity is reached at the expense of use of traditional processes thresh fruitful weight, and processing improvement of quality fresh the threshed seeds – at the expense of processing of all grains in a magnetic field and etc.

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## Editorial Column

### NEWS

**International Conference on New Research In Agri-food and Tourism**  
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