Quality, Safety and Spoilage Issues in the Wine Industry

The Importance of Tailored Starter Cultures to Ensure the Quality and the Safety of 'Wild', Organic, Biodynamic, and Typical Wines

Vittorio Capozzi, Pasquale Russo, Giuseppe Spano
International Association for Food Protection

IAFP is a member-based association of more than 4,000 food safety professionals committed to Advancing Food Safety Worldwide® by providing food safety professionals worldwide with a forum to exchange information on protecting the food supply.
Fermented Foods Protection
Thank you
Aspasia

Thank you
Patrick
PDO AND PGI AGRICULTURAL PRODUCTS:
A 14.2 billion euro turnover for over 800 products
% of total turnover for PDO/PGI agricultural products

- Other 13%
- Bakery products, biscuits, confectionery 4%
- Fruit and vegetables 4%
- Fresh meat 6%
- Meat products 16%
- Beer 20%
- Cheese 37%
Geographical Indications
geographicAI
Precise Attributes
Microbial Terroir
pesticides:  =  starter:  

Autochthonous varieties:  =  indigenous microbes
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NATURAL OR SELECTED? THE ROLE OF FERMENTATION FOR A QUALITY CHEESE

Monday, September 23, 2013 - 11:00 AM Slow Food Stand, Piazza XX Settembre

Not only in industrial cheese making, but also in many artisanal realities is the production process of cheese fermentation more and more often entrusted to selected prepackaged starters. Using natural bacterial flora, traditionally inoculated using milk or whey cultures, seems to be a practice that has fallen by the wayside and, instead, the enzymes have begun to travel in little packages. So all you need is a kit of bacteria bits extracted from milk that we know nothing about – not its origin or its production techniques – to transform milk into a quality cheese?

Chaired by: Piero Sardo, president Slow Food Foundation for Biodiversity

With:
Ton Baars, Research Institute of Organic Agriculture (FIBL), Germany
Vittorio Capozzi, University of Foggia, Italy
Giampaolo Gaiarin, Fondazione E. Mach, S. Michele all’Adige, Trento, Italy
Starter's Orders!

Saturday, September 19, 2015 - 3 PM Biodiversity House

Commercial starter cultures can flatten out the quality of a cheese, but there is a solution. Cheesemakers can make their own starters from their own milk. Giampaolo Gaiarin will present the first fermenting vat designed to meet the needs of small-scale cheesemakers.

Chaired by Piero Sardo, president of the Slow Food Foundation for Biodiversity

With:
Giampaolo Gaiarin, Slow Food Trentino
Paolo Modenesi, ferment production industry
Massimo Nuriasso, commerce director at Dairy, Chr. Hansen Italia
Vittorio Capozzi, University of Foggia
Franco Di Nucci, cheesemaker

Translation available in English and Italian
What is in the packets?
Strains of bacteria extracted from milk produced who knows where in the
world, selected and
multiplied in specialized laboratories.
Are these packets the only solution?
Absolutely not.

There are alternatives that respect biodiversity and do not contribute to the
standardization of flavors, alternatives that look back to the ancient tradition
of the "mother" culture.
As with bread or vinegar, it is possible to prepare a kind of "cheese mother,"
a natural starter culture that can be obtained from milk or whey. Gaiairexplains one way of obtaining a natural starter, a thermophilic starter
culture: "You need to use milk from two or three farmers," explains Gaiaire.
"The milk is heated to 63-65°C, then cooled to 45-48°C, reaching the
optimal conditions for bacterial multiplication. This temperature is kept
constant until coagulation begins. Then the starter is poured off and
referred. Unlike bread starters, the milk culture is made fresh every two
days, at most every three days."
Though this type of practice requires more work, more conscientious care
and stricter supervision of timing and temperatures, in the end it is quite
simple.

So why is it not so widespread? Why does almost nobody teach or
promote it?
Firstly because behind the packets lies a big market, with powerful
companies who provide significant funding to research institutions. And also
because in the end the extra work is not fairly rewarded. The story of starter
cultures is not commonly known, and there are very few who are familiar
with their existence and importance, even among experts.
pesticides nothing
pesticides → nothing
pesticides → biological pest control → nothing
pesticides ——> nothing

Integrated pest management ——> biological pest control
starter → spontaneous
Business
manufacturing and services, primary sectors, financial sector, creative industries, social sector, large firms, SMEs, young entrepreneurs, students with business ideas, cluster and business organisations,

Research & education
public and private research bodies, universities, education and training, science and technology parks, Technology transfer offices, etc.

Public administration
If relevant at different government levels, agencies e.g. for regional development, business advice, public procurement offices, incubators, etc.

Civil society/Users
NGOs and citizens’ initiatives related to societal challenges for which innovative solutions would be helpful, consumers associations, Talents! etc.
SPONTANEOUS

PIED DE CUVE

SELECTED AUTOCHTHONOUS

COMMERCIAL STARTER CULTURES
SPONTANEOUS

PIED DE CUVE

SELECTED AUTOCHTHONOUS

COMMERCIAL STARTER CULTURES
SPONTANEOUS

PIED DE CUVE

SELECTED AUTOCHTHONOUS

COMMERCIAL STARTER CULTURES
SPONTANEOUS

BACKSLOPPING

SELECTED AUTOCHTHONOUS

COMMERCIAL STARTER CULTURES
SCIENTIFIC OPINION

Scientific Opinion on risk based control of biogenic amine formation in fermented foods

EFSA Panel on Biological Hazards (BIOHAZ)

European Food Safety Authority (EFSA), Parma, Italy

ABSTRACT

A qualitative risk assessment of biogenic amines (BA) in fermented foods was conducted, using data from the scientific literature, as well as from European Union-related surveys, reports and consumption data. Histamine and tyramine are considered as the most toxic and food safety relevant, and fermented foods are of particular BA concern due to associated intensive microbial activity and potential for BA formation. Based on mean content in foods and consumer exposure data, fermented food categories were ranked in respect to histamine and tyramine, but presently available information was insufficient to conduct quantitative risk assessment of BA, individually and in combination(s). Regarding BA risk mitigation options, particularly relevant are hygienic measures to minimize the occurrence of BA-producing microorganisms in raw material, additional microbial controls and use of BA-nonproducing starter cultures. Based on limited published information, no adverse health effects were observed...
Tastings: Slow Cheese and Slow Wine

One of the most effective, surprising and joyful ways we can understand the meaning of biodiversity is by tasting it. This is why part of the Slow Food area is dedicated to the discovery of the diversity of wine and raw-milk cheeses.

The world of cheeses offers the perfect example of how plant and animal biodiversity is articulated when transformed into food. In the Slow Cheese area, you’ll see that although it only takes three ingredients to make a cheese—milk, rennet and salt—an extraordinary diversity has still sprung from these simple origins, with over 2,000 traditional cheeses made around the world. Each tells the story of different places and pastures, of different types of milk and breeds, of different animal diets and production techniques, and of the skills of the herders and cheesemakers. Every raw-milk cheese is different, each closely rooted to its place of origin. This is completely unlike industrial or pasteurized cheeses, produced with commercial starter cultures, additives and preservatives, standardized and anonymous, and replicable anywhere in the world. They have no roots, no history, no emotion, and often no taste.
VINI - I vigneti più importanti danno i tre rossi di punta (non filtrati), per cui le fermentazioni, di norma tra 25 e 30 giorni, sono con lieviti indigeni. Il Roero Mompissano Ris.

2010 (6000 bt; 25€), 30 mesi in botti da 25 ettolitri ha struttura e finezza. La bellissima annata 2011 regala un Roero Audinaggio 2011 (4000 bt; 22€) vinoso ed elegante e, attualmente, un’ancora più godibile Barbera d’Alba Mulassa 2011 (4000 bt; 20€) che fa solo botti grandi. Un piccolo "segreto": aspettatevi un grande Mompissano in questo millesimo! Bevibilità e frutto contraddistinguono i vini più semplici: naso floreale e finale fruttato per il Roero Arneis Merica 2012 (24000 bt; 10€), un classico della categoria.


CONCIMI letame naturale, compost
FITOFARMACI rame e zolfo
DISERBO meccanico
LIEVITI selezionati, indigeni
UVE 100% di proprietà
CERTIFICAZIONE biologica
Campana Buffalo’s Mozzarella Cheese DOP, Latteria Turnaria Cheese, Castel del Monte Canestrato, Sparkenhoe Red Leicester. These are the four cheeses that will be on offer from July 6-12 in the Slow Cheese area at Expo.

Campana Buffalo’s Mozzarella Cheese DOP
This fresh stretched curd cheese was being made as early as the 13th century, but it was not until the 17th that it began to be produced on a large scale. Made up of very thin layers, it has an elastic texture in the first eight to ten hours after it is made, becoming more fondant as it matures. Whole buffalo’s milk is inoculated with a starter culture of the previous day’s whey and calf’s rennet. The curd is broken twice in the space of about half an hour and left to drain for 15-30 minutes. It is then left to

Latteria Turnaria Cheese
Italy / Friuli Venezia Giulia / Milk and milk products

Back to the archive
“starter whey is then added to the milk. This is a natural starter culture of lactic ferments obtained from the spontaneous acidification of the whey remaining after the previous day’s cheese processing”
“The leaven is made by adding ingredients at least three times to increase the fermenting dough, i.e. water and durum-wheat meal (20% of the durum-wheat flour used)”
“the wort (which is still hot) is cooled and taken to the fermentation vessels, where doses of yeast are carefully added from special, dedicated, pure cultures. All the pure cultures derive from a single yeast cell so that all the yeast cells determining the taste of Münchener Bier’ possess totally identical qualities. Addition of the special yeast(s), which is (are) aerated with Munich air, then triggers fermentation of the wort, lasting around 4e8 days” (OJ C 316, 22.12.2006, pp. 2e8).
English Farmhouse Cheddar

“The milk will be pumped into stainless steel vats and brought to the required temperature. **Starter culture is then added to produce** the acidity in the milk required during the early stages of cheese making. The starter is mixed into the milk before rennet (natural animal rennet or vegetable rennet or microbial rennet or genetically modified rennet) is added to coagulate the milk”
From the official web-site, we reported the following specification: “A special starter culture is added and the milk is stirred and slowly warmed to around 35° centigrade”.

English Farmhouse Cheddar
Roquefort

“Before it is pressed, the raw cheese is cultured with spores of *Penicillium roqueforti* [.] The *P. roqueforti* culture is added either in liquid form at the renneting stage or in powder form when the curd is placed in the mould [.] The cheese is left exposed in caves in Roquefort-sur-Soulzon, located in the scree of the Combalou mountain, for the length of time needed for the *P. roqueforti* to develop successfully” (OJ C 298, 11.12.2007, pp. 28e33).
From the official French documentation (J. 0. Numéro 21 du 25 janvier 2001 page 1283. Textes généraux. Ministère de l’agriculture et de la pêche. Décret du 22 janvier 2001 relatif à l’appellation d’origine contrôlée “Roquefort”): “The inoculation is done with powders and cultures of *P. roqueforti* prepared from traditional strains isolated in the microclimate of the caves in the delimited area of the town of Roquefort-sur-Soulzon defined in the Article 6”.

**Roquefort**
Microbial information regimen in EU geographical indications

Vittorio Capozzi*, Pasquale Russo, Giuseppe Spano

Department of Food Science, Foggia University, via Napoli 25, 71100 Foggia, Italy

ABSTRACT

Fermented food Geographical Indications (GIs), protected within the framework of Intellectual Property and Human Rights, are based on various forms of local knowledge and technical practices and on various aspects of local biodiversity, ranging from plant varieties and animal breeds to microbial ecosystem. In the light of the EC Regulation 510/2006 relating to the protection of EU GIs, information about microbial resource management in GIs production is not unequivocally defined. We argue that it is possible to integrate the microbial resource information regimen coherently within the intellectual property framework for GIs. Product specification of GI fermented foods might comprise a list of autochthonous microbial strains representing the “virtuous” microbial biodiversity of a specific terroir and for a given method of food production. The autochthonous strains should be genotypically and technologically characterized and deposited in microbial collections. This approach will be useful in improving the “unique qualities” of products, and in ensuring a strong focus on the biological risks for human health and industrial exigencies of product standardization. Additionally, it is important to underline that a multi-strain starter culture essentially satisfies the patentable criteria.
Slow microbes for slow food
The wine microbial consortium: A real terroir characteristic

By: V. Renouf, C. Miot-Sertier, P. Strehaiano, and A. Lonvaud-Funel

In: International Journal of Vine and Wine Sciences, 40 (4)209-216. 2006

In this paper the authors demonstrate significant microbial differences between 4 estates (or chateaux) in the Bordeaux area.

- The authors compare the microorganism population on the grapes at harvest of 4 estates, one in Graves (A), two in Libournais (B, C), and one in Medoc (D). Then, for important microbial genera (Saccharomyces cerevisiae, Bretanomyces bruxellensis, Oenococcus oeni), they go a step further and do the same comparisons at the strain level. Their goal is to determine whether the microbial “consortium” of a vineyard is unique enough to be considered a “terroir” characteristic. [In the original French article, the authors use the word “consortium” –maintained in the English translation- in the sense of “population”].
Biodiversity and the survival of autochthonous fermented products

José I. Garabal

Agricultural Research Center of Mabegondo, Xunta de Galicia, A Coruña, Spain

Many microorganisms isolated and characterized during the past century have received considerable attention from the pharmaceutical and/or food fermentation industry because of their potential biotechnological interest. Lactic acid bacteria (LAB), particularly those belonging to beneficial and non-pathogenic genera (*Lactococcus*, *Lactobacillus*, *Leuconostoc*, *Oenococcus*, and *Streptococcus*), have traditionally been used in the food industry. They also play an essential way to lactobacilli, which, due to their higher versatility for fermentation, can survive in cheeses at stages when concentrations of major carbohydrates and free water decrease, whereas the sodium chloride load increases. Apart from the above-mentioned major genera of LAB, other bacteria, including non-starter LAB and non-lactic-acid bacteria, as well as some fungi (yeasts, moulds), staphylococci, micrococci, coryneform bacteria, and propionic acid bacteria,
Food microbial biodiversity and “microbes of protected origin”

Vittorio Capozzi and Giuseppe Spano*

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TYPICAL FOOD AND GEOGRAPHICAL INDICATIONS

Over the past decades, traditional food systems have evolved from poorly coordinated networks to globalized complexes of regulated trade, and the geographical indications (GIs) agro-food market size is approximately $50 billion. Belonging to the intellectual property law as collective property rights, the “GI is a sign used on goods that have a specific geographical origin and possess qualities, reputation, or characteristics that are essentially attributable to that place of origin” (World Intellectual Property Organization [WIPO], 2011). The global impact of “GI” is widely ered by separate rules; Kireeva, 2011) and, according to estimates, it represents a total annual sales volume of approximately €14 billion (Italy, 8.9; France, 2.3; Germany, 2.0; Spain, 0.9; Profeta et al., 2009).

FOOD MICROBIOLOGY AND GEOGRAPHICAL INDICATIONS

The importance of fermented foods in the context of GIs is particularly relevant, due to the historic, cultural, and traditional significance (Battcock and Azam-Ali, 1998; Holtzman, 2006). For example, without considering wines, the percentages of the following food categories in the EU were: 37% cheeses, 20% beer, 16% meat, Csoma et al., 2010; Valmorri et al., 2010; Cocolin et al., 2011; Cordero-Bueso et al., 2011; Tristeza et al., 2011). In GIs product specification, the microbial attributes are recognized as geographical (territorial) traits and/or as a part of production characteristics (list of autochthonous species and strains, preparation of the natural starter culture, use of specific commercial starter cultures, the chemico-physical foodstuff factors responsible of microbial development). It is important to underline that the commercial starter cultures use might lead to losses in “unique qualities,” while the pursuit of wild natural fermentations (natural starter cultures) can result in fermentation...
Defining microbial terroir: The use of native fungi for the study of traditional fermentative processes

Daniel Felder*, Daniel Burns, David Chang

Momofuku, 853 Broadway Suite 1211, NY 10003, USA

Received 1 June 2011; accepted 1 August 2011
Available online 3 December 2011

Abstract

In any fermentative process, the impact of the native microbial community is hugely important. The present study examines the far-reaching implications of harvesting and isolating specific native fungi and bacteria to use as inoculum for new forms of traditional techniques. As a chef one not only has the chance to understand their craft on a cellular level, but to connect more deeply to the indigenous life of their environment, their “microbial terroir.” In the course of developing butabushi, koji and miso, DNA analysis has been performed throughout to understand the impact of our native microbes and to propagate them in controlled environments. It is a rare moment in an urban environment when a chef can grow anything, and rarer still to be able to connect with terroir. The goal of this project is to create truly indigenous products, through stewardship of our native microorganisms.

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Keywords: Microbiology; Terroir; Katsuobushi; Koji; Miso; Fermentation
A cartoon illustration of a cow with black spots, a yellow scarf, and brown horns. The cow is standing on four legs with a long tail.
Economic dimension

Environmental dimension

Social dimension

Scientific dimension
Global2Local
Sustainable
Sustainable development - Biodiversity

United Nations Decade on Biodiversity

CBD - Convention of Biological Diversity

Protected Designation of Origin
Commons, Science and Society
Results
Metabolites of Microbial Origin with an Impact on Health: Ochratoxin A and Biogenic Amines.
Russo P1, Capozzi V1, Spano G1, Corbo MR1, Sinigaglia M1, Bevilacqua A1.


Technological properties of Lactobacillus plantarum strains isolated from grape must fermentation.
Berbegal C1, Peña N2, Russo P3, Grieco F4, Pardo F5, Ferrer S5, Spano G6, Capozzi V3.


From grape berries to wine: population dynamics of cultivable yeasts associated to "Nero di Troia" autochthonous grape cultivar.
Garofalo C1, Tristeza M2, Grieco F2, Spano G3, Capozzi V1.


Microbial terroir and food innovation: The case of yeast biodiversity in wine.
Capozzi V1, Garofalo C1, Chiriatti MA2, Grieco F2, Spano G3.


The yeast Starmerella bacillaris (synonym Candida zemplinina) shows high genetic diversity in winemaking environments.
Masneuf-Pomarède I1, Juguin E2, Mirot-Sertier C3, Renault P4, Laizet Y5, Salin F5, Alexandre H6, Capozzi V7, Cocolin L8, Colonna-Ceccaldi B9, Englezos V8, Girard P9, Gonzalez B10, Lucas P11, Mas A10, Nislotou A12, Sipiczki M13, Spano G7, Tassou C12, Bely M11, Albertin W14.


Draft Genome Sequence of Lactobacillus plantarum Lp90 Isolated from Wine.
Lamontanara A1, Caggianiello G2, Orrù L1, Capozzi V2, Michelotti V1, Bayjanov JR3, Renckens B3, van Hijnum SA, Cattivelli L1, Spano G4.


Autochthonous starter cultures and indigenous grape variety for regional wine production.
Garofalo C1, El Khoury M2, Lucas P2, Bely M2, Russo P1, Spano G1, Capozzi V1.


Genome Sequences of Five Oenococcus oeni Strains Isolated from Nero Di Troia Wine from the Same Terroir in Apulia, Southern Italy.
Capozzi V1, Russo P1, Lamontanara A2, Orrù L2, Cattivelli L2, Spano G3.
Genome Sequence of Oenococcus oeni OM27, the First Fully Assembled Genome of a Strain Isolated from an Italian Wine.

Biodiversity and safety aspects of yeast strains characterized from vineyards and spontaneous fermentations in the Apulia Region, Italy.

Biogenic Amines Degradation by Lactobacillus plantarum: Toward a Potential Application in Wine.

Expression of Lactobacillus brevis IOEB 9809 tyrosine decarboxylase and agmatine deiminase genes in wine correlates with substrate availability.

Isolation and characterization of tyramine-producing Enterococcus faecium strains from red wine.

Technological properties of Oenococcus oeni strains isolated from typical southern Italian wines.
Capozzi V, Russo P, Beneduce L, Weidmann S, Grieco F, Guzzo J, Spano G.
Isolation and characterization of tyramine-producing Enterococcus faecium strains from red wine

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Fig. 4. Tyramine production by Enterococcus faecium inoculated in wine at the end of the alcoholic fermentation. Tyramine (mg/l) produced by E. faecium strain 0T23 inoculated in red wine at 10% (grey bars) or 12% (white bars) of ethanol content. Tyramine was quantified by HPLC at the end of the alcoholic fermentation (a), after 28 (b) and 60 days (c) of malolactic fermentation.
Biodiversity and safety aspects of yeast strains characterized from vineyards and spontaneous fermentations in the Apulia Region, Italy

Mariana Tristezza, Cosimo Vetrano, Gianluca Bleve, Giuseppe Spano, Vittorio Capozzi, Antonio Logrieco, Giovanni Mita, Francesco Grieco

*Corresponding author. Institute of Sciences of Food Production (ISPA), Operative Unit of Lecce, via Pro v. Lecco-Monteroni, 71100 Lecce, Italy; CASAREA, Società Cooperativa ARL, via Baracca Maggiore, 71043 Copertino, Lecce, Italy; Department of Science of Agriculture, Food and Environment, University of Foggia, via Napoli 25, 71122 Foggia, Italy; CNR - Institute of Sciences of Food Production (ISPA), via Amendola 166/80, 70126 Bari, Italy

Fig. 1. Examples of biogenic amines (BA) production by non-Saccharomyces yeasts isolated from Apulian grapes. TLC plate of extracts from supernatants of synthetic medium supplemented with histidine, lysine and arginine at 1% w/v concentration or tyrosine at 0.1% w/v concentration tyrosine 0.1% and inoculated with different yeast strains. Lanes 1 and 2, biogenic amine standard (50 mg/l and 0.5 mg/l, respectively); lane 3, L. elongispora strain 3KUT31; lane 4, Z. hellericus strain 2M2; lane 5, Z. hellericus strain 1KUT24; lane 6: M. pulcherrima strain 3KUT27. The position of different BAs is indicated to the left of the panel.
Autochthonous starter cultures and indigenous grape variety for regional wine production

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¹ Dipartimento di Scienze Agrarie, degli Alimenti e dell’Ambiente, Università di Foggia, Foggia, Italy
² University of Bordeaux, ISVV, Villenave d’Ornon, France

Figure 3 MFL performed with co-inoculation and sequential inoculation of yeast strain Saccharomyces cerevisiae E4 and Oenococcus oeni strains. Oenococcus oeni strains: UniFG 14 (a), UniFG 21 (b), UniFG 23 (c), UniFG 24 (d), UniFG 48 (e) and UniFG 6 (f). Concentration of l-malic acid (black colour) and l-lactic acid (grey colour), is reported. Continuous line represent the sequential inoculation, while dashed line represent the co-inoculation approach.
Intraspecific biodiversity and ‘spoilage potential’ of
*Brettanomyces bruxellensis* in Apulian wines

Maria Rosaria Di Toro\textsuperscript{a}, Vittorio Capozzi\textsuperscript{a}, Luciano Beneduce\textsuperscript{a}, Hervé Alexandre\textsuperscript{b}, Mariana Tristezza\textsuperscript{c}, Miriana Durante\textsuperscript{c}, Maria Tufariello\textsuperscript{c}, Francesco Grieco\textsuperscript{c}, Giuseppe Spano\textsuperscript{a}
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Vini Naturali e lievito madre

Angeli e demoni. Lieviti selezionati vs indigeni: chi è sicuro di aver capito tutto?

Vi sfidiamo: alla cieca non riuscereste a riconoscere se è lievito indigeno o selezionato!

Pied de cuve: i “Grandi”, 40 anni fa, avevano già capito tutto ...
Quality, Safety and Spoilage Issues in the Wine Industry

Position Paper on the management of microbial resources for the Quality and the Safety of 'Wild', Organic, Biodynamic, and Typical fermented foods/beverages
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