

VOL VIII

# AGRÁRIAS

PESQUISA E INOVAÇÃO NAS CIÊNCIAS QUE  
ALIMENTAM O MUNDO

EDUARDO EUGÊNIO  
SPERS  
(Organizador)

 EDITORA  
ARTEMIS

2022

VOL VIII

# AGRÁRIAS

PESQUISA E INOVAÇÃO NAS CIÊNCIAS QUE  
ALIMENTAM O MUNDO

EDUARDO EUGÊNIO  
SPERS  
(Organizador)

 EDITORA  
ARTEMIS

2022



O conteúdo deste livro está licenciado sob uma Licença de Atribuição Creative Commons Atribuição-Não-Comercial NãoDerivativos 4.0 Internacional (CC BY-NC-ND 4.0). Direitos para esta edição cedidos à Editora Artemis pelos autores. Permitido o download da obra e o compartilhamento, desde que sejam atribuídos créditos aos autores, e sem a possibilidade de alterá-la de nenhuma forma ou utilizá-la para fins comerciais.

A responsabilidade pelo conteúdo dos artigos e seus dados, em sua forma, correção e confiabilidade é exclusiva dos autores. A Editora Artemis, em seu compromisso de manter e aperfeiçoar a qualidade e confiabilidade dos trabalhos que publica, conduz a avaliação cega pelos pares de todos manuscritos publicados, com base em critérios de neutralidade e imparcialidade acadêmica.

<b>Editora Chefe</b>	Prof. <sup>a</sup> Dr. <sup>a</sup> Antonella Carvalho de Oliveira
<b>Editora Executiva</b>	M. <sup>a</sup> Viviane Carvalho Mocellin
<b>Direção de Arte</b>	M. <sup>a</sup> Bruna Bejarano
<b>Diagramação</b>	Elisângela Abreu
<b>Organizador</b>	Prof. Dr. Eduardo Eugênio Spers
<b>Imagem da Capa</b>	Shutterstock
<b>Bibliotecária</b>	Janaina Ramos – CRB-8/9166

#### Conselho Editorial

Prof.<sup>a</sup> Dr.<sup>a</sup> Ada Esther Portero Ricol, *Universidad Tecnológica de La Habana “José Antonio Echeverría”*, Cuba  
Prof. Dr. Adalberto de Paula Paranhos, Universidade Federal de Uberlândia  
Prof.<sup>a</sup> Dr.<sup>a</sup> Amanda Ramalho de Freitas Brito, Universidade Federal da Paraíba  
Prof.<sup>a</sup> Dr.<sup>a</sup> Ana Clara Monteverde, *Universidad de Buenos Aires, Argentina*  
Prof.<sup>a</sup> Dr.<sup>a</sup> Ana Júlia Viamonte, Instituto Superior de Engenharia do Porto (ISEP), Portugal  
Prof. Dr. Ángel Mujica Sánchez, *Universidad Nacional del Altiplano, Peru*  
Prof.<sup>a</sup> Dr.<sup>a</sup> Angela Ester Mallmann Centenaro, Universidade do Estado de Mato Grosso  
Prof.<sup>a</sup> Dr.<sup>a</sup> Begoña Blandón González, *Universidad de Sevilla, Espanha*  
Prof.<sup>a</sup> Dr.<sup>a</sup> Carmen Pimentel, Universidade Federal Rural do Rio de Janeiro  
Prof.<sup>a</sup> Dr.<sup>a</sup> Catarina Castro, Universidade Nova de Lisboa, Portugal  
Prof.<sup>a</sup> Dr.<sup>a</sup> Cirila Cervera Delgado, *Universidad de Guanajuato, México*  
Prof.<sup>a</sup> Dr.<sup>a</sup> Cláudia Padovesi Fonseca, Universidade de Brasília-DF  
Prof.<sup>a</sup> Dr.<sup>a</sup> Cláudia Neves, Universidade Aberta de Portugal  
Prof. Dr. Cleberton Correia Santos, Universidade Federal da Grande Dourados  
Prof. Dr. David García-Martul, *Universidad Rey Juan Carlos de Madrid, Espanha*  
Prof.<sup>a</sup> Dr.<sup>a</sup> Deuzimar Costa Serra, Universidade Estadual do Maranhão  
Prof.<sup>a</sup> Dr.<sup>a</sup> Dina Maria Martins Ferreira, Universidade Estadual do Ceará  
Prof.<sup>a</sup> Dr.<sup>a</sup> Eduarda Maria Rocha Teles de Castro Coelho, Universidade de Trás-os-Montes e Alto Douro, Portugal  
Prof. Dr. Eduardo Eugênio Spers, Universidade de São Paulo  
Prof. Dr. Eloi Martins Senhoras, Universidade Federal de Roraima, Brasil



Prof.ª Dr.ª Elvira Laura Hernández Carballido, *Universidad Autónoma del Estado de Hidalgo*, México  
Prof.ª Dr.ª Emilas Darlene Carmen Lebus, *Universidad Nacional del Nordeste/ Universidad Tecnológica Nacional*, Argentina  
Prof.ª Dr.ª Erla Mariela Morales Morgado, *Universidad de Salamanca*, Espanha  
Prof. Dr. Ernesto Cristina, *Universidad de la República*, Uruguay  
Prof. Dr. Ernesto Ramírez-Briones, *Universidad de Guadalajara*, México  
Prof. Dr. Gabriel Díaz Cobos, *Universitat de Barcelona*, Espanha  
Prof.ª Dr.ª Gabriela Gonçalves, Instituto Superior de Engenharia do Porto (ISEP), Portugal  
Prof. Dr. Geoffroy Roger Pointer Malpass, Universidade Federal do Triângulo Mineiro, Brasil  
Prof.ª Dr.ª Gladys Esther Leoz, *Universidad Nacional de San Luis*, Argentina  
Prof.ª Dr.ª Glória Beatriz Álvarez, *Universidad de Buenos Aires*, Argentina  
Prof. Dr. Gonçalo Poeta Fernandes, Instituto Politécnico da Guarda, Portugal  
Prof. Dr. Gustavo Adolfo Juarez, *Universidad Nacional de Catamarca*, Argentina  
Prof.ª Dr.ª Iara Lúcia Tescarollo Dias, Universidade São Francisco, Brasil  
Prof.ª Dr.ª Isabel del Rosario Chiyon Carrasco, *Universidad de Piura*, Peru  
Prof.ª Dr.ª Isabel Yohena, *Universidad de Buenos Aires*, Argentina  
Prof. Dr. Ivan Amaro, Universidade do Estado do Rio de Janeiro, Brasil  
Prof. Dr. Iván Ramon Sánchez Soto, *Universidad del Bío-Bío*, Chile  
Prof.ª Dr.ª Ivânia Maria Carneiro Vieira, Universidade Federal do Amazonas, Brasil  
Prof. Me. Javier Antonio Albornoz, *University of Miami and Miami Dade College*, Estados Unidos  
Prof. Dr. Jesús Montero Martínez, *Universidad de Castilla - La Mancha*, Espanha  
Prof. Dr. João Manuel Pereira Ramalho Serrano, Universidade de Évora, Portugal  
Prof. Dr. Joaquim Júlio Almeida Júnior, UniFIMES - Centro Universitário de Mineiros, Brasil  
Prof. Dr. José Cortez Godínez, Universidad Autónoma de Baja California, México  
Prof. Dr. Juan Carlos Cancino Diaz, Instituto Politécnico Nacional, México  
Prof. Dr. Juan Carlos Mosquera Feijoo, *Universidad Politécnica de Madrid*, Espanha  
Prof. Dr. Juan Diego Parra Valencia, *Instituto Tecnológico Metropolitano de Medellín*, Colômbia  
Prof. Dr. Juan Manuel Sánchez-Yáñez, *Universidad Michoacana de San Nicolás de Hidalgo*, México  
Prof. Dr. Júlio César Ribeiro, Universidade Federal Rural do Rio de Janeiro, Brasil  
Prof. Dr. Leinig Antonio Perazolli, Universidade Estadual Paulista (UNESP), Brasil  
Prof.ª Dr.ª Livia do Carmo, Universidade Federal de Goiás, Brasil  
Prof.ª Dr.ª Luciane Spanhol Bordignon, Universidade de Passo Fundo, Brasil  
Prof. Dr. Luis Fernando González Beltrán, Universidad Nacional Autónoma de México, México  
Prof. Dr. Luis Vicente Amador Muñoz, *Universidad Pablo de Olavide*, Espanha  
Prof.ª Dr.ª Macarena Esteban Ibáñez, *Universidad Pablo de Olavide*, Espanha  
Prof. Dr. Manuel Ramiro Rodríguez, *Universidad Santiago de Compostela*, Espanha  
Prof.ª Dr.ª Márcia de Souza Luz Freitas, Universidade Federal de Itajubá, Brasil  
Prof. Dr. Marcos Augusto de Lima Nobre, Universidade Estadual Paulista (UNESP), Brasil  
Prof. Dr. Marcos Vinicius Meiado, Universidade Federal de Sergipe, Brasil  
Prof.ª Dr.ª Mar Garrido Román, *Universidad de Granada*, Espanha  
Prof.ª Dr.ª Margarida Márcia Fernandes Lima, Universidade Federal de Ouro Preto, Brasil  
Prof.ª Dr.ª Maria Aparecida José de Oliveira, Universidade Federal da Bahia, Brasil  
Prof.ª Dr.ª Maria Carmen Pastor, *Universitat Jaume I*, Espanha  
Prof.ª Dr.ª Maria do Céu Caetano, Universidade Nova de Lisboa, Portugal  
Prof.ª Dr.ª Maria do Socorro Saraiva Pinheiro, Universidade Federal do Maranhão, Brasil  
Prof.ª Dr.ª Maria Lúcia Pato, Instituto Politécnico de Viseu, Portugal

Prof.<sup>a</sup> Dr.<sup>a</sup> Maritza González Moreno, *Universidad Tecnológica de La Habana*, Cuba  
Prof.<sup>a</sup> Dr.<sup>a</sup> Mauriceia Silva de Paula Vieira, Universidade Federal de Lavras, Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Odara Horta Boscolo, Universidade Federal Fluminense, Brasil  
Prof. Dr. Osbaldo Turpo-Gebera, *Universidad Nacional de San Agustín de Arequipa*, Peru  
Prof.<sup>a</sup> Dr.<sup>a</sup> Patrícia Vasconcelos Almeida, Universidade Federal de Lavras, Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Paula Arcoverde Cavalcanti, Universidade do Estado da Bahia, Brasil  
Prof. Dr. Rodrigo Marques de Almeida Guerra, Universidade Federal do Pará, Brasil  
Prof. Dr. Saulo Cerqueira de Aguiar Soares, Universidade Federal do Piauí, Brasil  
Prof. Dr. Sergio Bitencourt Araújo Barros, Universidade Federal do Piauí, Brasil  
Prof. Dr. Sérgio Luiz do Amaral Moretti, Universidade Federal de Uberlândia, Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Silvia Inés del Valle Navarro, *Universidad Nacional de Catamarca*, Argentina  
Prof.<sup>a</sup> Dr.<sup>a</sup> Solange Kazumi Sakata, Instituto de Pesquisas Energéticas e Nucleares. Universidade de São Paulo (USP), Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Teresa Cardoso, Universidade Aberta de Portugal  
Prof.<sup>a</sup> Dr.<sup>a</sup> Teresa Monteiro Seixas, Universidade do Porto, Portugal  
Prof. Dr. Valter Machado da Fonseca, Universidade Federal de Viçosa, Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Vanessa Bordin Viera, Universidade Federal de Campina Grande, Brasil  
Prof.<sup>a</sup> Dr.<sup>a</sup> Vera Lúcia Vasilévski dos Santos Araújo, Universidade Tecnológica Federal do Paraná, Brasil  
Prof. Dr. Wilson Noé Garcés Aguilar, *Corporación Universitaria Autónoma del Cauca*, Colômbia

#### **Dados Internacionais de Catalogação na Publicação (CIP)**

A277 Agrárias: pesquisa e inovação nas ciências que alimentam o mundo - Vol. VIII / Organizador Eduardo Eugênio Spers. – Curitiba-PR: Artemis, 2022.

Formato: PDF

Requisitos de sistema: Adobe Acrobat Reader

Modo de acesso: World Wide Web

Inclui bibliografia

ISBN 978-65-87396-68-2

DOI 10.37572/EdArt\_260822682

1. Ciências agrárias. 2. Pesquisa. 3. Agronegócio. 4. Agroecologia. I. Spers, Eduardo Eugênio (Organizador). II. Título.

CDD 630

**Elaborado por Bibliotecária Janaina Ramos – CRB-8/9166**



## APRESENTAÇÃO

As Ciências Agrárias são um campo de estudo multidisciplinar por excelência, e um dos mais profícuos em termos de pesquisas e aprimoramento técnico. A demanda mundial por alimentos e a crescente degradação ambiental impulsionam a busca constante por soluções sustentáveis de produção e por medidas visando à preservação e recuperação dos recursos naturais.

A obra **Agrárias: Pesquisa e Inovação nas Ciências que Alimentam o Mundo** compila pesquisas atuais e extremamente relevantes, apresentadas em linguagem científica de fácil entendimento. Na coletânea, o leitor encontrará textos que tratam dos sistemas produtivos em seus diversos aspectos, além de estudos que exploram diferentes perspectivas ou abordagens sobre a planta, o meio ambiente, o animal, o homem e a sociedade no ambiente rural.

É uma obra que fornece dados, informações e resultados de pesquisas tanto para pesquisadores e atuantes nas diversas áreas das Ciências Agrárias, como para o leitor que tenha a curiosidade de entender e expandir seus conhecimentos.

Este Volume VIII traz 26 artigos de estudiosos de diversos países, divididos em quatro eixos temáticos: *Cultura e Sociedade no Contexto Rural; Produção Sustentável; Produção Vegetal e Solos e Aquacultura, Produção Animal e Veterinária.*

Desejo a todos uma proveitosa leitura!

Eduardo Eugênio Spers

## SUMÁRIO

### CULTURA E SOCIEDADE NO CONTEXTO RURAL

#### **CAPÍTULO 1..... 1**

DESAFIOS DE UMA PAISAGEM CULTURAL MEDITERRÂNICA: O MONTADO, O TIRADOR DE CORTIÇA E A TRANSMISSÃO DO SABER-FAZER TRADICIONAL

Sónia Bombico

Carlos Manuel Faísca

 [https://doi.org/10.37572/EdArt\\_2608226821](https://doi.org/10.37572/EdArt_2608226821)

#### **CAPÍTULO 2.....28**

DISEÑO DE UN SISTEMA DE BUENAS PRACTICAS AGRICOLAS COMO ESTRATEGIA DE IMPLEMENTACION EN LA ASOCIACION APRIMUJER UBICADA EN EL MUNICIPIO DE SAN VICENTE DE CHUCURI

Leidy Andrea Carreño Castaño

Mónica María Pacheco Valderrama

Héctor Julio Paz Díaz

Miguel Arturo Lozada Valero

Rafael Calderón Silva

Jhoan Arley Ochoa Martínez

Angélica María Montoya Hernández

Irina Alean Carreño

Shirley Mancera

Daniel Augusto Buitrago Ibañez

Ana Milena Salazar

Sandra Milena Montesino Rincón

 [https://doi.org/10.37572/EdArt\\_2608226822](https://doi.org/10.37572/EdArt_2608226822)

#### **CAPÍTULO 3..... 38**

ESPECIES FORESTALES DE IMPORTANCIA CULTURAL DE BADIRAGUATO SINALOA

Yulisa Rodríguez López

Heréndira Flores Almeida

Gilberto Sandoval Varela

Bladimir Salomón Montijo

Aidé Avendaño Gómez

 [https://doi.org/10.37572/EdArt\\_2608226823](https://doi.org/10.37572/EdArt_2608226823)

**CAPÍTULO 4..... 50**

CONTRIBUCIÓN POTENCIAL DE LAS SEMILLAS DE *Carica papaya* Linn Y SU ACEITE EN LA SALUD

Amelia Andrea Espitia Arrieta  
Jennifer Judith Lafont Mendoza  
Ana Karina Paternina Zapa

 [https://doi.org/10.37572/EdArt\\_2608226824](https://doi.org/10.37572/EdArt_2608226824)

**CAPÍTULO 5.....62**

PROTOTIPOS DE INNOVACIÓN SOCIAL EN PESCA ARTESANAL, REGIÓN DE LOS RÍOS – CHILE

Griselda Ilabel Pérez  
Meyling Tang Ortiz  
Claudio Barrientos Aguila

 [https://doi.org/10.37572/EdArt\\_2608226825](https://doi.org/10.37572/EdArt_2608226825)

**PRODUÇÃO SUSTENTÁVEL**

**CAPÍTULO 6.....70**

CONCEPTO DE BIORREFINERÍA: DESARROLLO SOSTENIBLE Y PROPUESTA DE PROCESO LIMPIO EN LA EXTRACCIÓN DE COMPUESTOS FENÓLICOS DE RESIDUOS INDUSTRIALES DE PISTACHO (*Pistacia vera* var. *Kerman*)

Daniela Zalazar-García  
Rosa Rodriguez  
María Paula Fabani  
Germán Mazza  
Marcelo Echegaray  
Romina Zabaleta  
Eliana Sanchez  
Erick Torres

 [https://doi.org/10.37572/EdArt\\_2608226826](https://doi.org/10.37572/EdArt_2608226826)

**CAPÍTULO 7..... 83**

REDUCCIÓN DE LA CANTIDAD DE VINAZA POR AUMENTO DE LA CONCENTRACIÓN FINAL DE ETANOL POR FERMENTACIÓN DE *Saccharomyces cerevisiae*

María Laura Muruaga  
María Gabriela Muruaga  
Cristian Andrés Sleiman  
Nora Inés Perotti

 [https://doi.org/10.37572/EdArt\\_2608226827](https://doi.org/10.37572/EdArt_2608226827)



**CAPÍTULO 8.....97**

EVALUACIÓN DE LA *CHLORELLA SP* Y LA *DUNALIELLA TERTIOLECTA* COMO FUENTE POTENCIAL DE ÁCIDOS GRASOS PARA LA PRODUCCIÓN DE BIODIESEL

Dally Esperanza Gáfaró Álvarez  
Mónica María Pacheco Valderrama  
Daniel Augusto Buitrago Ibañez  
Yuleisi Tatiana Caballero Hernandez  
Leidy Andrea Carreño Castaño  
Ana Milena Salazar Beleño  
Miguel Arturo Lozada Valero  
Leidy Carolina Ortiz Araque  
Olga Cecilia Alarcón Vesga  
Sandra Milena Montesino Rincón  
Cristian Giovanni Palencia Blanco  
Nora Milena Ortiz Garcia

 [https://doi.org/10.37572/EdArt\\_2608226828](https://doi.org/10.37572/EdArt_2608226828)

**CAPÍTULO 9..... 110**

A TEMPORARY IMMERSION SYSTEM (TIS) BIOREACTOR USED FOR THE IN VITRO PROPAGATION OF *PRUNUS* AND *PYRUS* ROOTSTOCKS

Carlos Rolando Mendoza  
Ramon Dolcet-Sanjuan

 [https://doi.org/10.37572/EdArt\\_2608226829](https://doi.org/10.37572/EdArt_2608226829)

**CAPÍTULO 10.....125**

CARACTERIZAÇÃO DE CORANTES PARA ELABORAÇÃO DE CEREJAS CANDEADA: ERITROSINA VERSUS VERMELHO GARDENIA

Juan Ignacio González Pacheco  
Mariela Beatriz Maldonado  
Ariel Fernando Márquez Agüero  
Emanuel Félix Condori Laura  
Paula Anabella Giorlando Videla

 [https://doi.org/10.37572/EdArt\\_26082268210](https://doi.org/10.37572/EdArt_26082268210)

**PRODUÇÃO VEGETAL E SOLOS**

**CAPÍTULO 11..... 141**

THE QUALITY OF APPLE FRUIT PRODUCTS WHEN USING THE GROWTH BIOREGULATOR ALBIT IN THE SYSTEM OF PROTECTION

Svetlana Levchenko  
Elena Stranishevskaya

Elena Matveikina  
Vladimir Boiko  
Nadezhda Shadura  
Vitalii Volodin  
D. Belash  
Ya. Volkov  
Marina Volkova

 [https://doi.org/10.37572/EdArt\\_26082268211](https://doi.org/10.37572/EdArt_26082268211)

**CAPÍTULO 12 ..... 151**

THE EFFECT OF VEGETATIVE TREATMENT OF GRAPES WITH A PREPARATION  
BASED ON AMINO ACIDS ON THE PHENOLIC COMPLEX OF BERRIES

Svetlana Levchenko  
Elena Ostroukhova  
Sofia Cherviak  
Vladimir Boyko  
Dmitriy Belash  
Irina Peskova  
Nataliya Lutkova  
Mariya Viugina  
Olga Zaitseva  
Aleksandr Romanov

 [https://doi.org/10.37572/EdArt\\_26082268212](https://doi.org/10.37572/EdArt_26082268212)

**CAPÍTULO 13 ..... 162**

ANÁLISIS FÍSICOQUÍMICO DE ACEITES SEMILLAS CON APROVECHAMIENTO  
POTENCIAL ZONAS TROPICALES

Amelia Andrea Espitia Arrieta  
Jennifer Judith Lafont Mendoza

 [https://doi.org/10.37572/EdArt\\_26082268213](https://doi.org/10.37572/EdArt_26082268213)

**CAPÍTULO 14 ..... 175**

PLAGAS DESENCADENANTES DE EPIFITIAS DEL CULTIVO DE PLATANO &  
ESTRATEGIAS DE CONTROL

Francisco Angel Simón Ricardo  
Renso Oswaldo Lozano Gámez  
Cristhian Andrés Méndez Cedeño  
Luis Pérez Vicente

 [https://doi.org/10.37572/EdArt\\_26082268214](https://doi.org/10.37572/EdArt_26082268214)

**CAPÍTULO 15 ..... 191**

EFFECTOS ABIÓTICOS DE LA SALINIDAD EN CULTIVOS DE ARÁNDANO BAJO RIEGO POR GOTEJO, EN LA PROVINCIA DE BUENOS AIRES

Alejandro Pannunzio

Pamela Texeira

Luciana Tozzini

 [https://doi.org/10.37572/EdArt\\_26082268215](https://doi.org/10.37572/EdArt_26082268215)

**CAPÍTULO 16 ..... 200**

EVALUACIÓN DEL RENDIMIENTO DEL GRANO CON LOS TRES HÍBRIDOS ASOCIADOS CON TRES NIVELES DE LA FERTILIZACIÓN NITROGENADA EN EL CULTIVO DE MAÍZ ENTRE LA ASPERSIÓN Y GOTEJO POR FERTIRIEGO DURANTE LA ESTACIÓN SECA EN UN SUELO VERTISOL

Kentaro Tomita

Jaime Proaño

 [https://doi.org/10.37572/EdArt\\_26082268216](https://doi.org/10.37572/EdArt_26082268216)

**CAPÍTULO 17 ..... 209**

APLICAÇÃO DE TÉCNICAS DE MACHINE LEARNING PARA CLASSIFICAÇÃO DA APTIDÃO DOS SOLOS PARA O REGADIO

Pedro Torres

António Canatário Duarte

João Gerales

Sílvia Marques

 [https://doi.org/10.37572/EdArt\\_26082268217](https://doi.org/10.37572/EdArt_26082268217)

**AQUACULTURA, PRODUÇÃO ANIMAL E VETERINÁRIA**

**CAPÍTULO 18 ..... 225**

INFLUENCIA DE LAS VARIABLES MORFOLÓGICAS Y POBLACIONALES DE *Eichornia crassipes* Y *Pistia stratiotes* SOBRE LA COMUNIDAD DE MACROINVERTEBRADOS ACUÁTICOS EN UNA MADRE VIEJA DEL VALLE DEL CAUCA

Daniel Feriz Garcia

Jency Nathaly Palacio Bayer

Laura Melissa Muños Burbano

 [https://doi.org/10.37572/EdArt\\_26082268218](https://doi.org/10.37572/EdArt_26082268218)

**CAPÍTULO 19 .....239**

**AVALIAÇÃO DO CRESCIMENTO DE ACHIGÃS PRODUZIDOS EM AQUACULTURA**

António Moitinho Rodrigues

António Vasco de Mello

Miguel de Mello

Filipa Inês Pitacas

 [https://doi.org/10.37572/EdArt\\_26082268219](https://doi.org/10.37572/EdArt_26082268219)

**CAPÍTULO 20 .....250**

**EFICÁCIA DO TRATAMENTO COMBINADO DE AMITRAZ E FLUMETRINA NO CONTROLO DA VARROOSE**

Maria Alice Carvalho Hipólito

Catarina Manuela Almeida Coelho

Sância Maria Afonso Pires

Jorge Belarmino Ferreira de Oliveira

 [https://doi.org/10.37572/EdArt\\_26082268220](https://doi.org/10.37572/EdArt_26082268220)

**CAPÍTULO 21 .....263**

**CAPTACIÓN Y DISTRIBUCIÓN DE AGUA PARA RIEGO DE PASTURAS EN CHIPAUQUIL (DPTO. VALCHETA). ARGENTINA**

Juan José Gallego

Ciro Adrián Saber

Germán Cariac

Pablo Giovinne

Julio Argentino Llampá

Horacio Alberto Pallao

Diego Milipil

Hernán Zelmer

Roberto Angel Molina

Ines Mora Jara

María Victoria Cortés

 [https://doi.org/10.37572/EdArt\\_26082268221](https://doi.org/10.37572/EdArt_26082268221)

**CAPÍTULO 22 .....270**

**POTENCIALES MECANISMOS POR LOS CUALES SE MANIFIESTAN LAS ENFERMEDADES INFECCIOSAS EMERGENTES DEL CERDO**

Carlos J. Perfumo

Mariana Machuca

Alejandra Quiroga

 [https://doi.org/10.37572/EdArt\\_26082268222](https://doi.org/10.37572/EdArt_26082268222)

**CAPÍTULO 23 .....285**

CONFORTO TÉRMICO PARA FRANGOS DE CORTE EM CENÁRIOS DE MUDANÇA CLIMÁTICA NO RS

Zanandra Boff de Oliveira  
Emanuel Luis Christmann  
Eduardo Leonel Bottega  
Tiago Rodrigo Francetto

 [https://doi.org/10.37572/EdArt\\_26082268223](https://doi.org/10.37572/EdArt_26082268223)

**CAPÍTULO 24 .....298**

GANADERÍA EQUINA EXTENSIVA, FIESTAS Y PRODUCTOS TRADICIONALES: COOPERATIVA MONTE CABALAR Y RAPA DAS BESTAS DE SABUCEDO (A ESTRADA, PONTEVEDRA)

Francisco Xavier Barreiro  
Adolfo Cano Guervós

 [https://doi.org/10.37572/EdArt\\_26082268224](https://doi.org/10.37572/EdArt_26082268224)

**CAPÍTULO 25 .....316**

VINCRISTINA SUBCUTÁNEA COMO VIA ALTERNATIVA PARA EL TRATAMIENTO DE TUMOR VENÉREO TRANSMISIBLE EN PERROS

Gloria Beatriz Cabrera Suarez  
David Octavio Rugel González

 [https://doi.org/10.37572/EdArt\\_26082268225](https://doi.org/10.37572/EdArt_26082268225)

**CAPÍTULO 26 .....326**

A MASTITE E SEU EFEITO NO DESEMPENHO ZOOTÉCNICO E QUALIDADE DO LEITE

Greyce Kelly Schmitt Reitz  
Mariana Monteiro Boeng Pelegrini  
Pietra Viertel Molinari  
Fabiana Moreira  
Ivan Bianchi  
Juliano Santos Gueretz  
Vanessa Peripolli  
Elizabeth Schwegler

 [https://doi.org/10.37572/EdArt\\_26082268226](https://doi.org/10.37572/EdArt_26082268226)

**SOBRE O ORGANIZADOR.....332**

**ÍNDICE REMISSIVO .....333**

# CAPÍTULO 12

## THE EFFECT OF VEGETATIVE TREATMENT OF GRAPES WITH A PREPARATION BASED ON AMINO ACIDS ON THE PHENOLIC COMPLEX OF BERRIES

Data de submissão: 28/04/2022

Data de aceite: 16/05/2022

**Vladimir Boyko**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0002-2401-7531>

**Svetlana Levchenko**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0001-5423-0520>

**Dmitriy Belash**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0003-3525-2948>

**Elena Ostroukhova**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0003-0638-9187>

**Irina Peskova**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0002-5107-518X>

**Sofia Cherviak**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0001-9551-7448>

**Nataliya Lutkova**

Federal State Budget Scientific  
Institution “All-Russian National  
Research Institute of Viticulture and  
Winemaking “Magarach” of the  
Russian Academy of Sciences”  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0002-8126-7596>

### Mariya Viugina

Federal State Budget Scientific  
Institution "All-Russian National  
Research Institute of Viticulture and  
Winemaking "Magarach" of the  
Russian Academy of Sciences"  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0001-6146-2151>

### Olga Zaitseva

Federal State Budget Scientific  
Institution "All-Russian National  
Research Institute of Viticulture and  
Winemaking "Magarach" of the  
Russian Academy of Sciences"  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0002-8204-5610>

### Aleksandr Romanov

Federal State Budget Scientific  
Institution "All-Russian National  
Research Institute of Viticulture and  
Winemaking "Magarach" of the  
Russian Academy of Sciences"  
Kirova Street, 31, 298600  
Yalta, Russian Federation  
<https://orcid.org/0000-0002-9999-2657>

**ABSTRACT:** One of the modern problems of winemaking is the lag in the formation of the phenolic complex of berries in relation to the accumulation of sugars during the ripening of grapes. This leads to a distortion of the established organoleptic styles of red wines. It seems promising to influence the metabolism of grapes in the direction of increasing the synthesis of secondary metabolites through the use of foliar dressings. The precursors of the formation of phenolic compounds in the plant cell amino acids. We studied the effect of foliar fertilizers based on a complex of amino acids ("Siamino Pro 500), introduced at the beginning of grape ripening, on the phenolic compounds in grape berries of 4 cultivars from the South Coast zone of the Crimea. Using HPLC, it was revealed that at a similar

level of sugar accumulation (in the range 183-218 g L<sup>-1</sup>), the content of anthocyanins complex in the skins of the experimental grapes of 'Merlot' and 'Shiraz' was 71% and 12% higher than in the control ( $\alpha < 0.05$ ); in 'Cabernet Sauvignon' and 'Sangiovese' it was 17% and 45% less. Experimental processing of 'Merlot' and 'Shiraz' grapes led to an increase in the content of monoglucosides of delphinidin, cyanidin, formed from predecessors, by an average of 1.7 times. In 'Cabernet Sauvignon' and 'Sangiovese', the treatment stimulated the conversion of anthocyanins, increasing the proportion of monoglucosides of malvidin by 1.2 and 1.4 times.

**KEYWORDS:** Phenolic compounds. Phenolic maturity. Complex of amino acids. Berry skin. Seeds.

### O EFEITO DO TRATAMENTO VEGETATIVO DE UVAS COM PREPARAÇÃO À BASE DE AMINOÁCIDOS NO COMPLEXO FENÓLICO DE BAGAS

**RESUMO:** Um dos problemas modernos da vinificação é o atraso na formação do complexo fenólico das bagas em relação ao acúmulo de açúcares durante o amadurecimento das uvas. Isto leva a uma distorção dos estilos organolépticos estabelecidos de vinhos tintos. Parece promissor influenciar o metabolismo das uvas no sentido de aumentar a síntese de metabólitos secundários através do uso de coberturas foliares. Os precursores da formação de compostos fenólicos nos aminoácidos das células vegetais. Estudamos o efeito de fertilizantes foliares à base de um complexo de aminoácidos ("Siamino Pro 500), introduzido no início do amadurecimento da uva, sobre os compostos fenólicos em bagas de uva de 4 cultivares da zona da costa sul da Crimeia. Usando HPLC, foi revelado que em um nível semelhante de acúmulo de açúcar (na faixa de 183-218 g L<sup>-1</sup>), o teor de complexo antocianinas nas cascas das uvas

experimentais 'Merlot' e 'Shiraz' foi de 71% e 12 % maior que no controle ( $\alpha < 0,05$ ), em 'Cabernet Sauvignon' e 'Sangiovese' foi 17% e 45% menor. O processamento experimental das uvas 'Merlot' e 'Shiraz' levou a um aumento no teor de monoglicosídeos de delphinidina, cianidina, formada a partir de antecessores, em média 1.7 vezes. Em 'Cabernet Sauvignon' e 'Sangiovese', o tratamento estimulou a conversão de antocianinas, aumentando a proporção de monoglicosídeos de malvidina em 1.2 e 1.4 vezes.

**PALAVRAS-CHAVE:** Compostos fenólicos. Maturidade fenólica. Complexo de aminoácidos. Casca de baga. Sementes.

## 1 INTRODUCTION

One of the modern problems of winemaking associated with climate change in the direction of increasing ambient temperature is the lag in formation of berry phenolic complex relative to accumulation of sugars during grape ripening. Consequently, research on grapevine genetic diversity has intensified toward finding varieties characterized by early synthesis of anthocyanins in ontogeny under various abiotic environmental factors (Teixeira et al., 2013; Pastore et al., 2017; Garcia et al. 2018); and cross breeding and genetic studies based on creating new genotypes with high climatic plasticity and berry component composition potential for high quality wines (Risovannaya et al., 2017; Ostroukhova et al., 2019., Davis et al, 2012; Adjeva et al, 2015). Studies are underway to modify the anthocyanin pathway using regulatory and structural genes (Boss et al. 1996, Ananga, et al. 2013). The impact on grape metabolism in the direction of increasing the synthesis of secondary metabolites through agronomic practices seems promising (Zhao et al, 2005). It is known that the biosynthesis of phenolic compounds is based on a combination of acetate-malonate and shikimate reactions, with the bulk of phenolic compounds coming from hydroxycinnamic acids, which are formed from phenylalanine and tyrosine (Heldt and Piechulla, 2011). Current studies indicate a positive effect of biostimulants on the intensification of biosynthesis processes, increased resistance to stress and increased pigment content in berries due to stimulation of the phenylalanine pathway. The positive effect of the combined application of nitrogen and potassium fertilizers on the synthesis of polyphenols and the improvement of berry color characteristics in grapes was established (Delgado, 2006). Considering that most of the amino acids in the plant are capable of transformation from one form to another through amination and reamination reactions, treatment of plants with preparations containing amino acids can intensify the synthesis of secondary metabolites, in particular phenolic substances.

The research is devoted to evaluation of the influence of amino acid preparation application at the phenological phase of vegetation “the beginning of berry ripening” the final of ripening stages on formation of phenolic complex of berries and phenolic maturity of the crop.



## 2 MATERIALS AND METHODS

### 2.1 PROCEDURE AND CONDITIONS OF THE EXPERIMENT

Experimental studies were carried out during 2020 on grape ‘Cabernet-Sauvignon’, ‘Merlot’, ‘Shiraz’ and ‘Sangiovese’ from mountain-valley zone of viticulture of Crimea. Planting scheme was 3.0 × 1.5 m. Bushes shape was a cordon on a middle trunk. Vertical shoot positioned trellising system was used. Single foliar treatment with a preparation based on a complex of amino acids (600 g L<sup>-1</sup>) “Seamino Siamino Pro 500” at the rate of 1 kg ha<sup>-1</sup> was carried out on the experimental plot (1 ha for each cultivar). The preparation was applied in at the phenological phase of vegetation “the beginning of berry ripening”. System of agricultural actions without “Seamino Pro 500” application served as a control.

### 2.2 SAMPLE PREPARATION AND CHEMICAL ANALYSIS OF GRAPES

Grape samples from control and experimental plots were taken during the commercial harvesting period (September 10, 2020). Healthy bunches were sampled diagonally of plots, from the shady, sunny, upper, middle and lower parts of bushes. The total weight of each sample was 20 kg. Technological assessment of grapes was carried out according to parameters: of mass concentration of sugars, (Compendium, 2017) and phenolic maturity.

The phenolic maturity of grapes was assessed using the Glories method, based on the determining the potential amount of anthocyanins in the grape berry ( $A_{pH1,0}$ ), concentration of easily extractable anthocyanins in the winemaking conditions ( $A_{pH3,2}$ ), proportion of easily extractable anthocyanins from their potential amount ( $E_a = A_{pH3,2} \times 100 / A_{pH1,0}$ ), the proportion of seed tannins ( $M_p$ ) (Glories, 1998; Rajha, 2017;). The method makes it possible to assess the potential of the present proanthocyanidins and anthocyanins, as well as their ability to be extracted from grapes during processing and further technological operations (Rajha, 2017).

### 2.3 PHENOLIC COMPLEX ANALYSIS BY HPLC METHOD

The quantitative and qualitative composition of the polyphenol complex in the studied samples was determined by HPLC using the Agilent Technologies system (model 1100) with a diode-matrix detector. A Zorbax SBC18 chromatographic column was used for the separation of substances; chromatograms were recorded at the following wavelengths: 280 nm for gallic acid, (+)-D-catechin, (-)-epicatechin and procyanidins, 313 nm for hydroxycinnamic acids derivatives, 371 nm for quercetin and 525 nm for anthocyanins. The substances were identified by comparing their spectral characteristics

in terms of retention time with similar characteristics of the standards. Gallic acid, caffeic acid, (+)-D-catechin, malvidin 3-O-glucoside chloride, quercetin dihydrate, isoquercitrin (FlukaChemie AG, Switzerland), (-)-epicatechin, syringic acid (SigmaAldrich, Switzerland) were used as standards.

## 2.4 STATISTICAL ANALYSIS OF THE DATA

All chemical analyses were performed in triplicate. The entries were mathematically processed with the help of statistical software package SPSS Statistics 17.0. Arithmetic mean value, variance of a single result and standard deviation (SD) were determined. Significance of the difference of indicators in grapes of control and experimental batches was estimated by U-test. The predetermined probability of an erroneous result ( $\alpha$ ) was less than 0.05.

## 3 RESULTS AND DISCUSSION

The application of dressing under experimental conditions had no significant effect on the accumulation of sugars in berries, which allowed us to evaluate the effect of the studied treatment on the phenolic complex of grapes at parity content of sugars in the experimental and control batches of grapes.

From the perspective of wine quality, an important characteristic of berry phenolic complex is, on the one hand, the level of accumulation and extraction of skin anthocyanins; on the other hand, the degree of polymerization and extraction of seed polyphenols (Ribereau-Gayon, et al., 2006; Ren et al., 2017).

Monomeric and dimeric phenolic components of flavonoid and non-flavonoid structure were identified in the skin of the experimental and control lots of grapes using HPLC analysis (Table 1). The content of the components in the control lots of grapes ranged from  $1630.6 \pm 97.8$  mg kg<sup>-1</sup> of skin ('Merlot') to  $6868.0 \pm 549.4$  mg kg<sup>-1</sup> ('Cabernet Sauvignon'). The vegetative treatment of grapes with amino acid based preparation had ambiguous effect on the components content in berry skin: in 'Merlot' and 'Shiraz' grapes their concentration was increased (by 67% and 3% respectively), in 'Cabernet Sauvignon' and 'Sangiovese' - it decreased by 23% and 50%.

The proportion of anthocyanins among identified components in the skins of control lots of grapes ranged from 54% ('Cabernet Sauvignon') to 83% ('Merlot') and increased by 2%-6% under the influence of vegetative treatment of grapes. At the same time, the mass concentration of anthocyanins complex in the skin of the experimental batches of 'Cabernet Sauvignon' and 'Sangiovese' grapes was 17% and 45% lower than in

the control lots, amounting to  $3065.8 \pm 122.6$  and  $1206.3 \pm 78.4$  mg kg<sup>-1</sup>. In contrast, the content of anthocyanins complex in 'Merlot' and 'Shiraz' grapes under the influence of its treatment with 'Si amino Pro 500' increased by 71% and 12%, reaching  $2306.0 \pm 161.4$  and  $2598.5 \pm 90.9$  mg kg<sup>-1</sup>, respectively.

Table 1. The content (arithmetic mean value<sup>1</sup>, mg kg<sup>-1</sup>) of phenolic compounds in the skin of berries.

Phenolic compounds	'Cabernet Sauvignon'		'Merlot'		'Sangiovese'		'Shiraz'	
	control	experiment	control	experiment	control	experiment	Control	experiment
Hydroxybenzoic and hydroxycinnamic acids	87.1	40.5	19.8	25.1	20.6	18.1	49.9	68.6
Flavonols	91.2	119.3	26.9	42.9	9.8	3.0	49.3	52.3
Flavan-3-ols	2045.9	1462.9	165.5	298.4	481.5	166.3	1095.6	935.4
Procyanidins	941.1	510.2	74.0	48.4	178.7	22.7	308.5	266.2
Anthocyanins:								
delphinidin-3-O-β-D-glucoside	358.2	172.9	106.8	199.3	380.2	116.3	173.8	126.0
cyanidin-3-O-β-D-glucoside	79.3	18.2	15.4	22.3	300.3	99.3	29.7	81.2
petunidin-3-O-β-D-glucoside	293.2	131.1	96.6	171.7	377.6	167.2	193.4	375.7
peonidin-3-O-β-D-glucoside	188.9	71.8	53.3	89.7	205.6	124.1	154.8	155.8
malvidin-3-O-β-D-glucoside	1501.3	1567.4	605.7	1211.8	919.8	683.3	994.9	916.9
delphinidin-3-O-β-D-glucoside-6-O-acetate	75.8	42.6	16.8	34.0	0.6	1.4	32.5	147.7
cyanidin-3-O-β-D-glucoside-6-O-acetate	22.9	10.3	4.7	7.1	1.1	0.6	12.6	52.1
petunidin-3-O-β-D-glucoside-6-O-acetate	105.4	50.9	24.3	46.0	1.3	3.7	53.1	196.9
peonidin-3-O-β-D-glucoside-6-O-acetate	3.4	1.1	0.0	3.4	1.1	1.7	6.6	2.7
malvidin-3-O-β-D-glucoside-6-O-acetate	601.2	716.8	204.4	331.7	6.1	2.3	297.1	363.0
petunidin-3-O-β-D-glucoside-6-O-p-coumarate	52.3	15.9	17.0	14.1	6.2	0.4	35.4	41.1
malvidin-3-O-β-D-glucoside-6-O-p-coumarate	420.9	266.9	199.4	175.0	12.4	6.1	331.5	139.4
<b>Total anthocyanins:</b>	3702.8	3065.8	1344.4	2306.1	2212.3	1206.3	2315.4	2598.5
<b>Total phenolic components</b>	6868.0	5198.8	1630.6	2720.9	2902.9	1416.5	3818.7	3921.0

<sup>1</sup>SD-values were lower than 9% for all assays.

Siamino Pro 500 treatment in 'Merlot' grapes stimulated biosynthesis of anthocyanins from precursors quercetin and myricetin (Teixeira et al., 2013; Mattioli et al., 2020), as evidenced by 1.9 and 1.5-fold increases ( $\alpha < 0.05$ ) in monoglucosides of delphinidin, cyanidin, and their derivatives acylated by acetic acid or by p-coumaric acid, and by interconversion of anthocyanins, as indicated by an average 1.7-fold increase in monoglucosides of malvidin, peonidin, petunidin and their derivatives. The increase in the content of the anthocyanin complex in the experimental lots of 'Shiraz' grapes was due to the increased formation of monoglucosides of delphinidin, cyanidin and their derivatives (1.6-fold) and monoglucosides of petunidin (2.2-fold), at the same time there was a 13% decrease in the content of monoglucosides of malvidin relative to control. Considering that the final metabolites of the chain of transformation of anthocyanin compounds of *Vitis vinifera* use cursives for scientific name are malvidin-3-O- $\beta$ -D-glucoside and its derivatives (Narduzzi et al., 2015), the presented data suggest that the anthocyanin complex accumulated in the experimental batches of 'Shiraz' grapes is in the stage of active interconversion of components. In 'Cabernet Sauvignon' grapes the vegetative treatment did not lead to the intensification of biosynthesis of anthocyanins from precursors: on the contrary, the content of monoglucosides of delphinidin, cyanidin and their derivatives in experimental lots was 2 and 3.6 times lower than in control. At the same time, the use of top dressing stimulated mutual transformation of anthocyanins, as evidenced by the increased proportion of monoglucosides of malvidin (from 68% in the control batches to 83% - in the experimental), while the proportion of all other components of the anthocyanin complex decreased. Similar effect was exerted by the treatment on the formation of anthocyanin complex of 'Sangiovese' grape skins. At the same time, in both control and experimental batches, a low proportion of monoglucosides of malvidin (42% and 57%, respectively) with relatively high proportions of monoglucosides of cyanidin, peonidin, petunidin, which indicates incomplete processes of mutual transformation of components and/or variety-specific features of the 'Sangiovese' anthocyanin complex.

The observed effect of vegetative grape treatment on the content and component composition of anthocyanins complex of berry skin was reflected in a significant ( $\alpha < 0.05$ ) increase in the concentration of easily extractable anthocyanins in 'Sangiovese' and 'Shiraz' by 24 % and 47 % relative to control (Table 2).

Table 2. Indicators of phenolic maturity of grapes from experimental and control lots (1).

Cultivar	Option	$A_{pH1.0}$	$A_{pH3.2}$	Ea, %	Mp, %
		mg L <sup>-1</sup>	mg L <sup>-1</sup>		
'Cabernet Sauvignon'	control	1150±67	602±24	52±1	23±1
'Cabernet Sauvignon'	experiment	1104±55	604±24	55±2	21±1
'Merlot'	control	1293±71	651±20	50±1	24±2
'Merlot'	experiment	1031±41	618±21	60±3	20±1
'Sangiovese'	control	1190±36	343±14	29±2	21±2
'Sangiovese'	experiment	841±42	425±17	50±3	14±2
'Shiraz'	control	1468±66	528±26	36±2	23±2
'Shiraz'	experiment	1377±69	776±29	56±2	30±3

<sup>1</sup> arithmetic mean value ±SD;  $A_{pH1.0}$  – potential amount of anthocyanins in the grape berry;  $A_{pH3.2}$  – concentration of easily extractable anthocyanins in the winemaking conditions; Ea – proportion of easily extractable anthocyanins from their potential amount; Mp – the proportion of seed tannins

The grapes of the experimental batches of all cultivars were characterized by a higher proportion of easily extractable anthocyanins from their potential amount (Ea), reflecting the proportion of easily extractable anthocyanins in the anthocyanin complex. In the experimental grapes 'Sangiovese' and 'Shiraz' the increase of Ea index was 20-21%, in the grapes 'Cabernet Sauvignon' and 'Merlot' - 3-10%. Thus, treatment of grapes with "Siamino Pro 500" promoted formation of anthocyanin complex, and at the same level of accumulation of sugars the grapes of experimental batches were characterized by better indicators of "phenolic maturity".

Regarding the other phenolic components of grape skins, it should be noted (Table 1) that in the experimental batches of grapes of all varieties the mass concentration of flavan-3-ols and procyanidins decreased by 2% ('Sangiovese') - 93% ('Shiraz') and 14% ('Shiraz') - 72% ('Sangiovese') respectively.

Phenolic complex of seeds changed under the influence of vegetative treatment of grapes (Table 3). The content of phenolic components in the seeds of the control lots varied from 513.3 ± 40.1 mg kg<sup>-1</sup> ('Sangiovese') to 2299.1±137.9 mg kg<sup>-1</sup> ('Shiraz' in the seeds of experimental lots - less by 12% ('Cabernet Sauvignon') to 38% ('Sangiovese') relative to the control values. The phenolic complex of the seeds of the control and experimental lots of 'Sangiovese' grapes differed by a high proportion of hydroxybenzoic and hydroxycinnamic acids - 21%, and procyanidins and flavan-3-ols accounted for 74% in the experimental lots and 76% in the control. In all other cases, the proportion of procyanidins and flavan-3-ols in the phenolic complex of seeds of control and experimental lots of grapes was 91-96%. A simultaneous reduction in the content of flavan-3-ols (by 3 - 27%) and procyanidins (by 15 - 45%) in the seeds of 'Merlot', 'Sangiovese' and 'Shiraz' grapes was observed under

the effect of vegetative treatment. In the seeds of 'Cabernet Sauvignon' grapes of the experimental lots, the content of flavan-3-ols decreased by 50% relative to control, while the concentration of procyanidins increased by 60%.

Table 3. The content (arithmetic mean value<sup>1</sup>, mg kg<sup>-1</sup>) of phenolic compounds in the seeds.

Phenolic compounds	'Cabernet Sauvignon'		'Merlot'		'Sangiovese'		'Shiraz'	
	control	experiment	control	experiment	control	experiment	control	experiment
Hydroxybenzoic and hydroxycinnamic acids	42.1	77.9	73.7	37.5	110.0	66.7	79.8	39.0
Flavonols	4.6	9.0	1.7	2.4	11.9	2.5	18.5	36.5
Flavan-3-ols	754.1	373.8	282.1	207.1	69.5	58.0	732.7	709.1
Procyanidins	354.7	568.5	479.0	405.7	321.7	77.4	1358.8	1092.6
Anthocyanins:	11.5	2.0	1.4	2.7	0.37	11.4	9.2	7.1
Total phenolic compounds	116.0	1031.2	837.9	655.4	513.4	216.0	2199.0	1884.2

<sup>1</sup>SD-values were lower than 9% for all assays.

The data presented, on the one side indicate that the applied treatment did not stimulate the biosynthesis of procyanidins and flavan-3-ols in grape seeds and grape skins. On the other side, vegetative treatment of grapes promoted oxidative polymerization of components with the formation of high-molecular-weight tannins, which led to a decrease in easily extractable monomeric and dimeric flavonoids.

The analysis of grapes according to the Glories method (Glories and Vivas, 1998). Table 2 showed a decrease ( $\alpha < 0.05$ ) in the extractable polyphenols of seeds in the experimental lots of 'Cabernet Sauvignon', 'Merlot', 'Sangiovese' by 2-7%, which indicates a higher degree of technological maturity of their phenolic complex compared to control. In 'Shiraz' grapes the share of extractable seed polyphenols in the experimental lots was 7% higher than in the control. This indicates incomplete processes of oxidative polymerization and condensation of seed polyphenols.

## 4 CONCLUSIONS

Thus, the treatment of grapes with the preparation "Siamino Pro 500" in the cvs. 'Cabernet Sauvignon', 'Merlot', 'Sangiovese', 'Shiraz' at the beginning of berry ripening stimulated the formation of monoglucosides of delphinidin, cyanidin from precursors (1.7 times on average) and/or transformation of anthocyanins, increasing the proportion of monoglucosides of malvidin in anthocyanins complex by 1.2-1.4 times. At the same time, application of amino-acid-based fertilizer under the experimental conditions had no effect

on the biosynthesis of procyanidins and flavan-3-ols in berry seeds and skin, but it apparently promoted their oxidative polymerization, which reduced the content of procyanidins by 14-72%, flavan-3-ols - by 2-93%. The effect of vegetative treatment of grapes phenolic complex of berries was the improvement of yield phenolic maturity indicators at a close level of sugars accumulation: the share of extractable seed polyphenols decreased, and easily extractable anthocyanins - increased by 3-21%.

## LITERATURE CITED

Adzhieva, V.F., Babak, O.G., Shoeva, O.Yu., Kilchevsky, A.V., and Khlestkina, E.K. (2015) Molecular-genetic mechanisms underlying fruit and seed coloration in plants. *Vavilov Journal of Genetics and Breeding*. 19 (5), 561573. DOI 10.18699/VJ15.073. (in Russian)

Ananga, A., Georgiev, V., Ochieng, J., Phills, B., and Tsoleva, V. (2013) Production of anthocyanins in grape cell cultures: a potential source of raw material for pharmaceutical, food, and cosmetic industries. In: Poljuha D, Sladonja B (eds) *The Mediterranean Genetic Code - Grapevine and Olive*. InTech DOI:10.5772/54592

Boss, P.K., Davies, C., and Robinson, S.P. (1996). Analysis of the expression of anthocyanin pathway genes in developing *Vitis vinifera* L. cv Shiraz grape berries and the implications for pathway regulation. *Plant Physiology*, 111, 1059-1066 DOI: 10.1104/pp.111.4.1059

Compendium of international methods of wine and must analysis. Paris. (2017)

Delgado, R., González, M.R., and Martín, P. (2006). Interaction effects of nitrogen and potassium fertilization on anthocyanin composition and chromatic features of Tempranillo grapes. *Journal international des sciences de la vigne et du vin*. 40 (3), 141-150 DOI:10.20870/oenone.2006.40.3.870

García-Esparza, M. J., Abrisqueta, I., Escriche, I., Intrigliolo, D. S., Álvarez, I., and Lizama, V. (2018). Volatile compounds and phenolic composition of skins and seeds of 'Cabernet Sauvignon' grapes under different deficit irrigation regimes. *Vitis* 57, 83–91 DOI: 10.5073/vitis.2018.57.83-91

Glories, Y. and Vivas, N. (1998). Maturation phenologique: definition et controle. Resume d'intervention presente par Julien Ducruet. *Universite Bordeaux II*. 1-10 (In France)

Heldt, H.-W., and Piechulla, B. (2011). *Plant Biochemistry*. 4-th edition, pp. 656.

Mattioli, R., Francioso, A., Mosca, L., and Silva, P. (2020). Anthocyanins: A Comprehensive Review of Their Chemical Properties and Health Effects on Cardiovascular and Neurodegenerative Diseases. *Molecules* 25, 3809 doi:10.3390/molecules25173809

Narduzzi, L., Stanstrup, J., Mattivi, F. (2015). Comparing wild American grapes with *Vitis vinifera*: a metabolomics study of grape composition. *J Agric Food Chem*. 63 (30), 6823-34 <https://doi.org/10.1021/acs.jafc.5b01999>

Ostroukhova E., Levchenko S., Likhovskoi V., Volynkin V., Peskova I., Vasylyk I. The dynamics of the phenolic complex of grapes during ripening: comparison of crimean autochthonous and classical cultivars. *Acta Horticulturae*. 2019. T. 1259. C. 105-113.

C. Pastore, S. Dal Santo, S. Zenoni, N. Movahed, G. Allegro, G. Valentini, I. Filippetti, G.B. Tornielli. Whole Plant Temperature Manipulation Affects Flavonoid Metabolism and the Transcriptome of Grapevine Berries *Front. Plant Sci.*, 8, 929 (2017).

Rajha, H.N., Darra, N.E., Kantar, S.E., Hobaika, Z., Louka, N., and Maroun, R.G. (2017). A comparative study of the phenolic and technological maturities of red grapes grown in Lebanon. *Antioxidants*, 6 (1), 8 <https://doi.org/10.3390/antiox6010008>

Ren, M., Wang, X., Du, G., Tian, C., Zhang, J., Song, X., and Zhu, D. (2017). Influence of different phenolic fractions on red wine astringency based on polyphenol/protein binding. *S. Afr. J. Enol. Vitic.* 38 (1), DOI:10.21548/38-1-1295

Ribereau-Gayon, P., Dubourdieu, D. Doneche, B. and Lonvaud, A. (2006). *Handbook of Enology. Volume 1. The Microbiology of Wine and Vinifications. 2nd Edition* (England: John Wiley & Sons, Ltd.). P. 497 (Trans. from French).

Risovannaya, V.I., Gorislavets S.M., Kolosova, A.A., and Volodin, V.A. (2017) Grape cultivar phenotyping on the basis of ampelometric, enochemical and enocarpological characteristics. *Magarach. Viticulture and Winemaking* 3, 25-28. (in Russian)

Teixeira, A., Eiras-Dias, J., Castellarin, S.D., and Gerós, H. (2013) Berry phenolics of grapevine under challenging environments. *International Journal of Molecular Sciences*. 14 (9), 18711-18739. <https://doi.org/10.3390/ijms140918711>

Zhao, J., Davis, L.C., and Verpoorte, R. (2005). Elicitor signal transduction leading to production of plant secondary metabolites. *Biotechnol. Adv.* 23 (4), 283–333 DOI: 10.1016/j.biotechadv.2005.01.003



## SOBRE O ORGANIZADOR

**EDUARDO EUGENIO SPERS** realizou pós-doutorado na Wageningen University (WUR), Holanda, e especialização no IGIA, França. Possui doutorado em Administração pela Universidade de São Paulo (USP). Foi Professor do Programa de Mestrado e Doutorado em Administração e do Mestrado Profissional em Comportamento do Consumidor da ESPM. Líder do tema Teoria, Epistemologia e Métodos de Pesquisa em Marketing na Associação Nacional de Pós-Graduação e Pesquisa em Administração (ANPAD). Participou de diversos projetos de consultoria e pesquisa coordenados pelo PENSE e Markestrat. É Professor Titular no Departamento de Economia, Administração e Sociologia, docente do Mestrado em Administração e Coordenador do Grupo de Extensão MarkEsalq no campus da USP/Esalq. Proferiu palestras em diversos eventos acadêmicos e profissionais, com diversos artigos publicados em periódicos nacionais e internacionais, livros e capítulos de livros sobre agronegócios, com foco no marketing e no comportamento do produtor rural e do consumidor de alimentos.

## ÍNDICE REMISSIVO

### A

Aceite 1, 28, 38, 50, 52, 53, 56, 57, 58, 59, 62, 70, 83, 97, 98, 99, 101, 102, 103, 106, 107, 108, 110, 125, 130, 141, 151, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 191, 200, 209, 225, 239, 250, 263, 270, 285, 298, 309, 316, 326

Aceites 33, 56, 57, 100, 107, 109, 162, 163, 165, 166, 168, 169, 170, 171, 172

Agua 33, 42, 47, 71, 72, 73, 74, 77, 78, 80, 81, 86, 87, 99, 101, 102, 103, 104, 105, 106, 107, 126, 130, 131, 133, 136, 163, 164, 167, 168, 169, 180, 187, 191, 192, 193, 194, 195, 196, 197, 198, 203, 204, 208, 211, 215, 216, 217, 225, 226, 227, 228, 230, 231, 236, 239, 241, 242, 244, 245, 246, 247, 263, 264, 265, 266, 267, 268, 269, 294, 295

Alimento composto 239, 244, 245

Amitraz 250, 251, 252, 254, 255, 256, 257, 258, 259, 261, 262

Análisis exergético 71, 75

Análisis fisicoquímicos 162, 163, 169

Apis mellifera 251, 252, 253, 260, 261

Aprendizagem Supervisionada 210, 212, 214

Aptidão solos regadio 210

Arándanos 191, 193, 195, 198

Aspersión 200, 202, 203, 204, 205, 208

Aumento de temperatura 286

Autoevaluación 29, 31, 32, 36

### B

Beneficio neto 200, 201

Berry skin 152, 155, 157

Biocombustibles 84, 85, 86, 96, 98, 99, 101, 102, 107, 108, 162, 163, 172

Biocultural 39, 49

Bioetanol 83, 84, 95, 109

Biological effectiveness 142, 146, 147, 148, 150

Biomarcadores 327, 328, 329

Biomasa vegetal 98, 99, 100, 102

### C

Cabalo de Pura Raza Galega 298, 299, 303, 310, 312, 313, 314

Carica papaya Linn 50, 51, 52, 53, 54, 55, 56, 57, 58, 60

Cepa 84, 89, 90, 91, 94, 95, 98, 99, 100, 103, 105, 106, 107, 139, 279  
Cepas hiperproductoras 84  
Cerdo 270, 271, 272, 274, 275, 276, 277, 278, 279, 308  
Cerezas 125, 126, 128, 129, 130, 131, 135, 136, 139  
Co-diseño 63  
Colorantes naturais 125, 126, 129, 130, 137, 138, 139  
Complex of amino acids 152, 154  
Comprimento 239, 243, 244, 245, 246, 247, 254  
Conditional parameters 142, 145, 148  
Curros 298, 299, 300, 310, 311, 314, 315

## E

Eficácia 143, 180, 217, 250, 251, 254, 256, 257, 258, 259, 260, 261, 307, 324  
Enfermedades Infecciosas Emergentes 270, 271  
Epifitias 175, 176, 177, 185  
Eritrosina 125, 126, 128, 130, 131, 132, 133, 135, 136  
Especies nativas 39, 40, 47  
Estabilidad 57, 126, 127, 130, 131, 136, 162, 169, 170, 172, 271  
Estresse Térmico 286, 294  
Extracción de compuestos fenólicos 70, 71, 80

## F

Fator K 239, 242, 243, 244, 245, 246, 247  
Fermentación 84, 85, 86, 87, 89, 90, 91, 94  
Fertilización nitrogenada 200, 202, 203, 206, 207  
Flumetrina 251, 254, 255, 256, 257, 258, 259  
Fruits 59, 60, 111, 142, 144, 145, 146, 148, 149

## G

Ganadería equina 298  
Glândula mamária 326, 327, 328, 329, 330  
Goteo por fertiriego 200, 202, 203, 204, 205, 206, 208  
GreenTray 110, 111  
GT bioreactor 110, 111, 112, 115, 116, 117, 118, 120, 121, 122, 123

## H

Humedal 225, 226, 227, 228, 231, 237, 238

## I

Immune 142, 143, 144

Influenza 3, 80, 102, 225, 226, 228, 234, 235, 236, 246, 296

Innovación social 62, 63, 66, 67, 68, 69

In vitro plant micropropagation 111

IRTA-reactor 111, 112

## L

Lactação 326, 327, 329, 330

Lípidos 50, 54, 57, 58, 99, 104, 105, 107, 244, 246

Liquid culture 110, 111, 112, 124

## M

Machine Learning 209, 210, 211, 212, 214, 223, 224

Macrófitas acuáticas 225, 226, 229, 230, 235, 236

Macroinvertebrados acuáticos 225, 226, 227, 228, 229, 238

Madre vieja 225, 226, 227, 228

Mal de Panamá 175, 176, 178

Mayos 39, 48

Mecanismos para su presentación 270

Mediterráneo 1, 3, 6

Métodos de extracción 72, 98, 106, 162

Microalgas 98, 99, 100, 101, 102, 103, 107, 108, 109

Micropterus salmoides 239, 240, 247, 248, 249

Moko bacteriano 175, 176

Morfología 190, 226

## N

Nematodos 175, 176, 177, 178, 179, 180, 182, 183, 184, 186, 187, 188, 189, 190

## O

Optimización de extracción 71

## P

Paisagem cultural 1, 2, 3, 22, 25  
Parrilla costal 316, 318, 323, 324  
Pasturas 263, 264, 265, 269  
Património cultural imaterial 1, 13, 22  
Perro 52, 316, 317, 318, 324  
Pesca artesanal 62, 63, 64, 69  
Peso 57, 73, 88, 92, 143, 166, 167, 168, 193, 215, 225, 229, 230, 239, 241, 242, 243, 244, 245, 246, 247, 252, 287, 318, 327, 329  
Phenolic compounds 59, 71, 72, 81, 82, 152, 153, 156, 159  
Phenolic maturity 152, 153, 154, 158, 160  
PH y temperatura 126, 131, 136  
Picudo negro 175, 176, 177, 180  
Potencialidades 4, 24, 50, 52, 53, 58, 162, 300  
Prácticas 28, 29, 30, 31, 32, 35, 36, 37, 40, 187, 188, 310  
Produção Animal 286, 326  
Productividad 191, 193, 316  
Productivity 111, 122, 123, 142, 143, 144, 149, 150, 192  
Prototipos 21, 62, 63, 68, 69

## Q

Questionários 1  
Quimioterapia 316, 317, 324

## R

Rapa das Bestas 298, 299, 310, 311, 314  
Razas autóctonas 298  
Represa 264, 266, 267, 268, 269  
Residuos industriales de pistacho 70, 71, 80  
Resolución 29, 31, 35, 37  
Resultados 1, 12, 16, 18, 19, 21, 22, 29, 32, 34, 39, 43, 47, 57, 58, 69, 71, 73, 74, 76, 79, 81, 88, 90, 95, 100, 106, 126, 131, 132, 133, 136, 168, 169, 170, 172, 182, 183, 184, 185, 187, 188, 194, 200, 201, 205, 207, 208, 209, 211, 213, 218, 222, 223, 230, 233, 239, 243, 245, 247, 251, 256, 257, 258, 267, 270, 279, 280, 289, 291, 304, 307, 316, 319, 324  
Riego 33, 180, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 204, 263, 264, 265, 266

Rojo gardenia 126

## S

Salinidad 102, 103, 104, 191, 192, 193, 194, 195, 196, 197, 198, 199

Salud 28, 29, 35, 50, 51, 52, 53, 54, 58, 72, 97, 125, 128, 129, 164, 271, 272, 273, 278, 279, 316, 324

Scikit-Learn 210

Seeds 51, 59, 60, 82, 152, 158, 159, 160, 173, 174

Semillas 47, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 85, 162, 163, 164, 165, 168, 169, 170, 172, 173, 174, 179, 208

Simulación numérica 71

Sistemas agroforestales 38, 39, 40, 41, 43, 47, 48

Sobreiro 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, 21, 24, 26

## T

Temporary immersion system 110, 111, 121, 122, 123, 124

Tiradores de cortiça 1, 2, 10, 11, 14, 16, 22, 23, 24

TIS 110, 111, 112, 115, 117, 122, 124

Tumor 316, 317, 319, 320, 321, 323, 324, 325

T.V.T 316, 317

## V

Valcheta 263, 264, 265

Validación de la innovación social 62, 63, 66, 67

Varroa destructor 250, 251, 252, 255, 259, 260, 261, 262

Vertiente 264, 265, 266, 267

Vertisol 200, 201, 202, 205

Vía subcutánea 316, 318, 323, 324

Vinaza 83, 84, 94, 95, 96