

VOL III

Estudos em Ciências Agrárias e Ambientais

Eduardo Spers
(Organizador)



EDITORA
ARTEMIS

2025

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INTRODUÇÃO

O campo das Ciências Agrárias e Ambientais é vasto e dinâmico, abrangendo uma diversidade de abordagens, técnicas e inovações essenciais para o avanço da agricultura, da pecuária e do manejo dos recursos naturais. Em um mundo em constante mudança, em que a sustentabilidade e a busca por soluções eficientes para os desafios ambientais são cada vez mais urgentes, a contribuição dos profissionais das agrárias se torna fundamental para a construção de um futuro mais equilibrado e saudável.

O Volume III de **Estudos em Ciências Agrárias e Ambientais** reúne pesquisas de autores de diversas partes do mundo, contribuindo com uma série de investigações que exploram desde os fundamentos da agroecologia até as complexas interações entre os seres humanos e o meio ambiente. A primeira parte aborda questões cruciais relacionadas à sustentabilidade, desde a utilização de biopreparados como soluções ecológicas até a medição de emissões poluentes em processos produtivos, refletindo o compromisso com práticas agrícolas que buscam respeitar os ciclos naturais e minimizar impactos negativos no planeta.

Em seguida, somos conduzidos a uma viagem pelo campo da genética e do melhoramento de plantas, uma área essencial para garantir a segurança alimentar global e o uso mais eficiente dos recursos naturais. Através de uma análise detalhada, os estudos nos apresentam a diversidade genética e os avanços que permitem o desenvolvimento de culturas mais resilientes e produtivas.

O livro também nos convida a refletir sobre os diferentes aspectos do manejo de cultivos, abordando desde as propriedades físicas das madeiras tropicais até as técnicas agrícolas adaptadas a regiões semiáridas, sempre com o olhar atento para as melhores práticas agrícolas, que promovem uma integração harmoniosa entre o ser humano e a terra.

Por fim, encontramos uma seção dedicada à produção animal, que explora o papel fundamental da pecuária na alimentação e economia global, além das questões relacionadas à saúde animal. A conexão entre a produção e a saúde dos animais é uma chave para garantir a qualidade e a sustentabilidade dos sistemas produtivos, abrangendo desde práticas de manejo até o desenvolvimento de estratégias veterinárias inovadoras.

Através destes trabalhos, buscamos oferecer uma visão abrangente e integrada de diversos aspectos das ciências agrárias, com o objetivo de contribuir para o avanço do conhecimento, da pesquisa e da prática no campo. Este é um convite à reflexão sobre o papel fundamental que a ciência e a inovação desempenham na construção de um futuro agrícola mais sustentável, saudável e próspero para todos.

Desejo a todos uma proveitosa leitura!

Eduardo Eugênio Spers

SUMÁRIO

AGROECOLOGIA E SUSTENTABILIDADE

CAPÍTULO 1..... 1

BIOPREPARADOS AGROECOLÓGICOS COMO SOLUÇÃO BIOLÓGICA

Joana Maria Ferreira dos Santos Correia Simões
Daniela de Vasconcelos Teixeira Aguiar da Costa
Cristina Isabel de Victoria Pereira Amaro da Costa

 https://doi.org/10.37572/EdArt_2803254511

CAPÍTULO 2..... 21

EXPERIMENTAL MEASUREMENTS OF POLLUTING EMISSIONS FROM COMBINED FEED FACTORIES FOR ENVIRONMENTAL PROTECTION

Cristian Vasile

 https://doi.org/10.37572/EdArt_2803254512

CAPÍTULO 3..... 30

ASOCIACIÓN DEL CULTIVO CACAHUATE (*Arachis hypogaea* L.) - MAÍZ (*Zea mays* L.) OCCIDENTAL AL SUROESTE DE GUANAJUATO

Alberto Calderón-Ruiz
Adriana Paola Martínez Camacho
Jorge Covarrubias-Prieto
Juan Carlos Raya-Pérez
Cesar Leobardo Aguirre-Mancilla
Salvador Montes-Hernández
María Susana Acosta-Navarrete

 https://doi.org/10.37572/EdArt_2803254513

CAPÍTULO 4..... 42

PRODUCCION DE BIOMASA EN MAIZ CON RIEGO POR GOTEO

Guillermo Jesuita Pérez Marroquín
Raul Berdeja Arbeu
Isidro López Sánchez
Ramiro Escobar Hernández
Fabian Enriquez Garcia
Marcos Perez Sato

Eutiquio Soni Guillermo

 https://doi.org/10.37572/EdArt_2803254514

GENÉTICA E MELHORAMENTO DE PLANTAS

CAPÍTULO 5..... 53

VARIACIONES ESPACIALES EN LA DISTRIBUCIÓN ACTUAL Y POTENCIAL DE *Pinus oocarpa Schiede ex Schltdl.* EN EL ESTADO DE JALISCO

José German Flores-Garnica

Gabriela Ramírez-Ojeda

 https://doi.org/10.37572/EdArt_2803254515

CAPÍTULO 6..... 63

LA DIVERSIDAD GENÉTICA DE *Pinus oocarpa*: UN RECURSO CLAVE PARA SU MEJORAMIENTO Y PRODUCCIÓN SOSTENIBLE DE RESINA

Miguel Ángel Vallejo Reyna

Mario Valerio Velasco García

Viridiana Aguilera Martínez

Hilda Méndez Sánchez

Liliana Muñoz Gutiérrez

Martín Gómez Cárdenas

Adán Hernández Hernández

 https://doi.org/10.37572/EdArt_2803254516

GESTÃO E MANEJO DE CULTIVOS

CAPÍTULO 7..... 72

STUDY OF SOME PHYSICAL PROPERTIES OF FIVE TROPICAL WOOD SPECIES

Guadalupe Olvera-Licona

José Amador Honorato-Salazar

Flora Apolinar-Hidalgo

 https://doi.org/10.37572/EdArt_2803254517

CAPÍTULO 8..... 82

CARACTERÍSTICAS AGRONÔMICAS DO RABANETE SOB QUANTIDADES DE MATA-PASTO (*Senna uniflora* L.) EM BASE VERDE INCORPORADO AO SOLO

Paulo César Ferreira Linhares

Lunara de Sousa Alves
Wyara Ferreira Melo
Janilson Pinheiro de Assis
Aline Carla de Medeiros
Patrício Borges Maracajá
Joaquim Odilon Pereira
Walter Martins Rodrigues
Karen Geovana da Silva Carlos
Geovanna Alicia Dantas Gomes
Maria Amanda Laurentino Freires

 https://doi.org/10.37572/EdArt_2803254518

CAPÍTULO 9.....92

BIOECOLOGY AND INTEGRATED MANAGEMENT OF ALIEN INVASIVE PEACH FRUIT
FLY *BACTROCERA ZONATA* SAUNDERS (DITPTERA: TEPHRTIDAE) IN SUDAN

Mohammed E. E. Mahmoud
Samira A. Mohamed
Mohamedazim I. B. Abuagla
Fathya M. Khamis
Sunday Ekesi

 https://doi.org/10.37572/EdArt_2803254519

CAPÍTULO 10..... 104

PRODUTIVIDADE DE MILHO (*Zea mays*), VARIEDADE CRIOULO, NA REGIÃO
SEMIÁRIDA EM FUNÇÃO DE DENSIDADES DE PLANTIO

Maria Elisa da Costa Souza
Paulo César Ferreira Linhares
Luciane Karine Guedes de Oliveira
Domingos Severino de Souza Junior
Lunara de Sousa Alves
Wyara Ferreira Melo
Aline Carla de Medeiros
Patrício Borges Maracajá
Joaquim Odilon Pereira
Walter Martins Rodrigues
Karen Geovana da Silva Carlos
Geovanna Alicia Dantas Gomes

 https://doi.org/10.37572/EdArt_28032545110

CAPÍTULO 11.....123

PODA DE FORMACIÓN EN PLANTAS DE LIMÓN PERSA DURANTE LA ETAPA DE ESTABLECIMIENTO

Pablo Ulises Hernández Lara

Sergio Salgado Velázquez

Diana Rubi Ramos López

 https://doi.org/10.37572/EdArt_28032545111

PRODUÇÃO ANIMAL E VETERINÁRIA

CAPÍTULO 12134

LOS MACHOS CABRÍOS FOTO-ESTIMULADOS SIN EXPERIENCIA SEXUAL INCREMENTAN LA TESTOSTERONA PLASMÁTICA DURANTE EL PRIMER CONTACTO SOCIO-SEXUAL CON HEMBRAS

Ilda G. Fernández

 https://doi.org/10.37572/EdArt_28032545112

CAPÍTULO 13139

MICOSIS EN MASCOTAS DE LA CIUDAD DE PUEBLA, MÉXICO

Alejandra Paula Espinosa Taxis

Teresita Spezzia Mazzocco

Fabiola Avelino Flores

 https://doi.org/10.37572/EdArt_28032545113

CAPÍTULO 14 150

A REVIEW OF THE STUDIES ON BLUEFIN TUNA (BFT) IN THE EASTERN ADRIATIC SEA

Vjekoslav Tičina

Ivan Katavić

Leon Grubišić

 https://doi.org/10.37572/EdArt_28032545114

CAPÍTULO 15165

INDUSTRIALIZACIÓN DE LÁCTEOS EN LA HACIENDA AGUSBELLA, PARROQUIA RUMIPAMBA, COMO RESULTADO DE LA PRÁCTICA PREPROFESIONAL DE ESTUDIANTES DE PRODUCCIÓN ANIMAL

María José Jiménez Arciniega

Nathaly Alexandra Freire Pazmay

Fabian Mauricio Tello Velastegui

 https://doi.org/10.37572/EdArt_28032545115

SOBRE O ORGANIZADOR.....	188
ÍNDICE REMISSIVO	189

CAPÍTULO 2

EXPERIMENTAL MEASUREMENTS OF POLLUTING EMISSIONS FROM COMBINED FEED FACTORIES FOR ENVIRONMENTAL PROTECTION

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ABSTRACT: Specialists in the field know very well that an important source of food for animals raised on livestock farms is the combined feeds, because in addition to ground cereals they also contain proteins, amino acids, minerals, vitamins and sometimes even certain medicines, energizers or flavors. The process of obtaining different varieties of combined feeds involves a complex technological flow, with specific stages of production. Mixing, sterilization and granulation activities, where steam jets are used at very high temperatures determine the elimination of different types of noxious substances in the air. In this article are presented the experimental measurements performed at the critical points of working installations from a combined feed factory, on the entire duration of the assortment lot. Considering the purpose of the performed

researches, the critical measurement points were established at the exit of steam generator, where steam jets are obtained at very high temperatures, with values of approximately 150-180°C. By using a gas analyzer of the type TESTO 350 M/XL, the measured values allow a complete analysis of the types of noxious emissions. The results of experimental measurements show that the fluctuations obtained during the measurements are very small, of the order 2 mg/m³_N for each type of noxious eliminated, which indicates a very good regulation of the work process. The average values of the eliminated noxious substances (CO, NO_x, CO₂) shows the full compliance with European environmental quality standards. The use of high-performance equipment and work devices, with a high degree of automation and computerization allows rigorous control over the different types of pollutants released in the atmosphere by the working installations from combined feed factories.

KEYWORDS: Combined feeds. Noxious emissions. Automation. Environment.

1 INTRODUCTION

Both the rapid demographic growth in recent decades and the diversification of human needs have led to an upward evolution of activities in the zootechnical field. Thus, the use of combined feeds for feeding animals on zootechnical farms has become very

necessary, both for providing good quality nutrients and for reducing the costs of animal products. Depending on the age of the animals or the species of animals fed, certain combined feed recipes are used, with different compositions, shapes and weights of the granules (Mihaila, 2001; Gaceu, 2006; Şara et al., 2005).

In a combined feed factory, a very complex technological flow takes place, during which the cereals and mineral substances that make up the desired recipe are mixed, homogenized, granulated and sterilized using high-performance equipment and working installations. From the combustion equipment that produces the steam necessary for sterilization and homogenization in different forms of combined feed and also from the cooling facilities of the final product, various types of pollutants are released into the atmosphere (Roden et al., 2006). These emissions of polluting substances can affect the health of people working in these factories and also the environment.

This is the main reason why it is absolutely necessary to monitor and control rigorously the concentrations of pollutant substances from the gases emitted by the work installations which have combustion sources or internal combustion engines (Heinsohn and Kabel, 1999; Lailer, 2005; Franke, 2006). At critical working points, that is, at the outlet of the hot steam generator, samples were taken and various experimental measurements were made in order to analyze the functional parameters of the work installations.

The paper presents a complex methodology for measuring the concentrations of different types of pollutants resulting from the process of obtaining combined feeds. Experimental analyzes and measurements for the determination of flue gases emissions from the steam generator outlet were performed using the TESTO 350 M/XL gas analyzer over a period of 100 minutes (which represents the minimum duration for making a batch of combined feed assortment). The experimental studies carried out propose an analysis of the functional parameters of the working installations in the combined feed factory, in order to automate the control of the steam temperature and implicitly of the combustion installation (that determines the elimination of noxious substances in the air). For this purpose, separate locations for experimental measurements were used in the burner area of the steam generator.

Given that each combined feed recipe requires different operating parameters of the work facilities, samples obtained during the technical process for the production of two combined feed recipes were analyzed: for the feeding of broilers, respectively for the feeding of swine.

2 MATERIALS AND METHODS

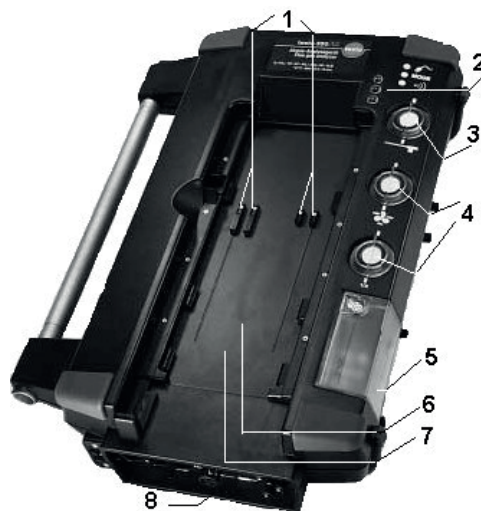
One of the stages of the technological flow from a combined feed factory is that in which the necessary ingredients from the recipe are mixed, which will be performed under the action of steam jets with very high temperatures. These jets are produced by a steam generator and are needed to obtain granules of different shapes and sizes (Bond et al., 2002). Also, the steam jet at very high temperatures has other important purposes in obtaining the final product: homogenization of granules and their sterilization. An essential work equipment from the combined feed factory where the experimental measurements were performed is the steam generator (Certuss Junior), having as primary fuel the liquefied petroleum gas (LPG).

Given the purpose of the research conducted, samples were taken at the outlet of the steam generator and experimental measurements were performed in order to analyze the working parameters of the equipment and installations used (Bollen et al., 2014). Thus, at this critical working point, the pollutant emissions from the flue gases resulting from the process of obtaining the steam jet were measured. During researches on flue gas, the TESTO 350 M/XL gas analyzer was used, in order to obtain the measured values for the noxious substances released at the outlet of the steam generator. This device operates according to the following principle: the change of the current intensity generated by a galvanic cell whose electrolyte changes its properties is analyzed (due to interaction with the gaseous component removed in the air to be detected and whose concentration is to be measured). Thus, the cells used to perform the measurements are in fact galvanic elements, which generate a current proportional to the number of ions that dissociate in the electrolyte solution (as a result of the reaction obtained between the electrolyte and the noxious substance analyzed at that time). Analyzers built according to this principle have a great advantage represented by a low construction cost and are used for short or medium duration measurements. With their help, concentrations can be determined for the following gases: O_2 , CO , H_2S , NO , NO_2 , SO_2 , etc.

The gas analyzer of the type TESTO 350 M/XL is an advanced equipment for determining the noxious substances eliminated by the flue gases, their determination being made in specialized measuring cells (in which Peltier type electrochemical reactions take place). The device used to perform analyzes in the combined feed factory where the research took place, consists of three working components: the analysis unit, the control unit and the gas sampling probe. The effective interaction between the electrolyte and the flue gases takes place in the unit of analysis, because this is where the reaction cells are located (figure 1). Also here are the supply batteries of the device, the filters for retaining

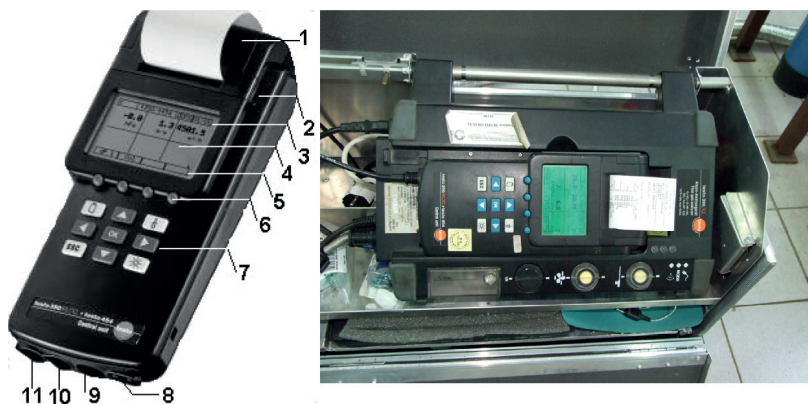
solid impurities from the flue gases, the condenser decanter and the electro-pneumatic connections with the other components.

Figure 1. The analysis unit: 1 - electrical contacts; 2 - control LEDs; 3 - solid particle filter; 4 - filters for retaining particles from the aspirated air; 5 - condensate collection; 6 - analysis cells; 7 - integrated system for determining the gas velocity and pressure; 8 - connections.



Due to the Peltier type electrochemical reactions that take place inside the analysis unit, an electrical signal is emitted to the control unit of the device, thus displaying the concentration value corresponding to the type of noxious substance analyzed (lonel, 1994). The TESTO 350 M/XL analyzer has a control unit (figure 2), which is a device that can be operated with the help of the built-in keyboard, or with a special contact pencil (touch-pen).

Figure 2. Control unit: 1 - printer; 2 - touch-pen; 3 - system information bar; 4 - display of measured values; 5 - bar for operation information; 6 - function operation keys; 7 - keyboard; 8 - pressure probe connection; 9 - sample connection; 10 - analysis unit connection; 11 - serial interface.



The analyzer can be equipped with several types of gas sampling probes, depending on the characteristics of the sampled gases. To performing the experimental measurements was used a probe with tubing heated at 180°C, operating at temperatures up to 1200°C.

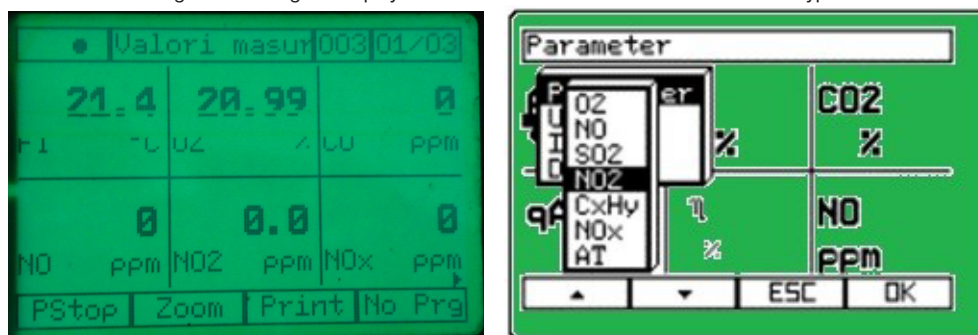
After the three components are interconnected, the analyzer will be switched on by connecting to the 220V mains or using its own batteries. At this point the device enters automatically in the procedure of “zero calibration” and washing of the reaction cells (figure 3). At the time of “zero calibration”, the probe of the device must not be inserted into the flue.

Figure 3. Zero calibration procedure of the Testo 350 M/XL analyzer.



After the analyzer enters in normal operation regimen, it must be programmed to acquire and display the data of interest for the analysis performed (Vasile, 2018). Also now is made the setting for the studied noxious type, from the device database (figure 4).

Figure 4. Setting the display of the desired values and the studied noxious type.



After setting the parameters we want to measure, the probe is inserted into the gas channel and the activity of measuring the monitored parameters is started (Vasile, 2018). The values obtained from the analysis and measurements carried out

will be compared with the limit values provided in the legislation in force (in order to confirm compliance with the rules imposed by the European Union). The measurements of the noxious concentrations eliminated by the flue gases from the steam generator were performed during the combined fodder production processes for two species of animals, with a large share in the livestock farms: broilers and swine. During 100 minutes (in which an assortment of combined fodder is produced), ten distinct measurements were performed for the noxious substances eliminated in the air (at an interval of 10 minutes between them).

If the TESTO 350 M/XL analyzer will be connected to a computer, it can be used for long term measurements (days, weeks) by running a special program: TESTO Easy Emissions.

3 RESULTS AND DISCUSSION

The thermodynamic parameters of the steam generator in the case of the production of combined feeds for broilers are: steam temperature in the installation 140°C; thermal agent temperature 170°C; nominal steam pressure 6 bar. The results of the measurements for the released emissions are presented in table 1.

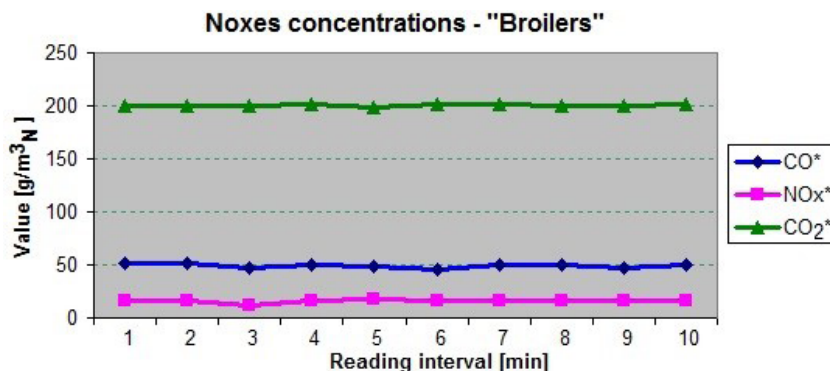
Table 1. Measurement values during combined feed production for broilers.

No.	CO [mg/m ³ _N]	NOx [mg/m ³ _N]	SO ₂ [mg/m ³ _N]	CO ₂ [g/m ³ _N]	CO* [mg/m ³ _N]	NOx* [mg/m ³ _N]	SO ₂ * [mg/m ³ _N]	CO ₂ * [g/m ³ _N]
1	46.25	14.37	0.00	182.44	50.79	15.78	0.00	200.36
2	46.25	14.37	0.00	182.44	50.79	15.78	0.00	200.36
3	42.50	10.26	0.00	182.44	46.67	11.27	0.00	200.36
4	45.00	14.37	0.00	182.63	49.69	15.87	0.00	201.68
5	45.00	16.42	0.00	182.63	49.09	17.91	0.00	199.24
6	41.25	14.37	0.00	182.63	45.55	15.87	0.00	201.68
7	45.00	14.37	0.00	182.63	49.69	15.87	0.00	201.68
8	45.00	14.37	0.00	182.44	49.42	15.78	0.00	200.36
9	42.50	14.37	0.00	182.44	46.67	15.78	0.00	200.36
10	45.00	14.37	0.00	182.63	49.69	15.87	0.00	201.68
Average	44.38	14.16	0.00	182.54	48.81	15.58	0.00	200.78

*) values relative to the reference oxygen 3%.

The results of the experimental measurements of the noxious concentrations eliminated in the production of combined feed for broilers are presented in graphical form in figure 5.

Figure 5. Concentrations of emitted pollutants in the case of combined feed for broilers.



The thermodynamic parameters of the steam generator in the case of the production of combined feed for swine are: the steam temperature in the installation 155°C; thermal agent temperature 180°C; nominal steam pressure 7.5 bar. The results of the measurements for the released emissions are presented in table 2.

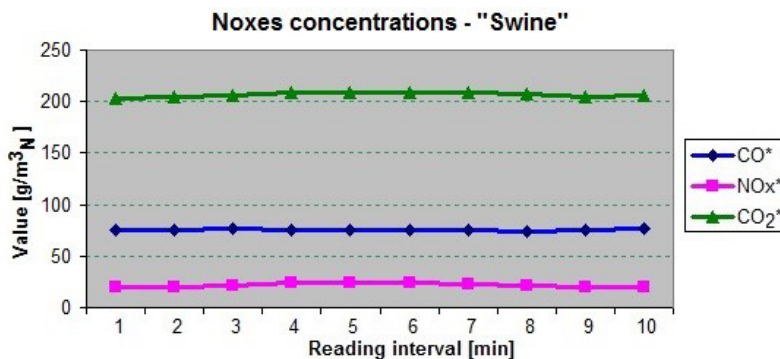
Table 2. Measurement values during combined feed production for swine.

No.	CO [mg/m ³ _N]	NOx [mg/m ³ _N]	SO ₂ [mg/m ³ _N]	CO ₂ [g/m ³ _N]	CO* mg/m ³ _N]	NOx* [mg/m ³ _N]	SO ₂ * [mg/m ³ _N]	CO ₂ * [g/m ³ _N]
1	63.20	17.33	0.00	170.20	75.61	20.34	0.00	203.74
2	63.24	17.35	0.00	170.35	75.61	20.57	0.00	203.96
3	63.25	17.41	0.00	171.08	76.60	20.70	0.00	206.28
4	61.85	19.37	0.00	171.31	75.10	23.56	0.00	208.62
5	61.93	19.24	0.00	172.15	75.25	23.73	0.00	208.40
6	61.95	19.42	0.00	172.40	75.30	23.80	0.00	208.54
7	62.15	19.46	0.00	172.69	75.10	23.17	0.00	208.79
8	61.82	17.30	0.00	172.82	74.18	20.61	0.00	206.85
9	63.20	17.18	0.00	170.95	75.61	20.48	0.00	204.12
10	63.30	17.36	0.00	171.26	76.05	20.55	0.00	205.98
Average	62.59	18.14	0.00	171.52	75.44	21.75	0.00	206.53

*) values relative to the reference oxygen 3%.

The results of the experimental measurements of the noxious concentrations eliminated in the production of combined feed for pigs are presented in graphical form in figure 6.

Figure 6. Concentrations of emitted pollutants in the case of combined feed for swine.



The measured values of the noxious substances from the flue gases for the two varieties of feed combined indicates very small fluctuations of the order $2 \text{ mg/m}^3_{\text{N}}$ for CO , NO_x , CO_2 and also that SO_2 is not eliminated in the air as an exhaust pollutant.

4 CONCLUSIONS

In order to increase the labor productivity in the combined feed factories, the aim is to increase the degree of automation of the activities in the technological flow, so as to ensure a fast and accurate measurement of the working parameters, required in obtaining the desired combined feed recipe. Meeting the requirements for pollution standards accepted in the European Union requires the use of high-performance work facilities, with a high degree of mechanization, automation and computerization.

Analyzing the measured values of the noxious substances from the flue gases for the two varieties of feed combined, it can be observed that the fluctuations obtained during the measurements are very small, of the order of $2 \text{ mg/m}^3_{\text{N}}$, for each type of noxious eliminated; this indicates a very good regulation of the work process. Another major advantage of the analyzed work installation is that SO_2 is not eliminated in the air as an exhaust pollutant; this consequence is associated with the burning of LPG in the steam generator.

As can be seen from the experimental research carried out, these automated equipments allow the rapid and permanent control of the temperatures of the steam jets, so that the noxious substances eliminated fall within the accepted limits.

The analyzes and experimental measurements performed at the output of the steam generator allowed the automated monitoring of the working parameters of the installation, in order to optimize the production process of different types of combined feeds. Also, the measured values for the concentrations of the pollutants eliminated

in the air by the steam generator burner were within the provided technical limits, fully complying with European environmental protection rules.

REFERENCES

- Bollen J., Brink C. (2014). Air pollution policy in Europe: Quantifying the interaction with greenhouse gases and climate change policies. *Energy Econ.*, pp. 202–215.
- Bond T.C., Covert D.S., Kramlich J.C., Larson T.V., Charlson R.J. (2002). Primary particle emissions from residential coal burning: Optical properties and size distributions, *Journal of Geophysical Research: Atmospheres*, vol. 107, no. D21, pp 1-14.
- Franke M., Rey A. (2006). Improving pellet quality and efficiency, Buhler AG Uzwil, Switzerland, *Feed Technology*, vol. 1, issue 3, pp. 5-9.
- Gaceu L. (2006). Modern techniques for drying cereals and technical plants, "Transilvania" Publishing House of University of Brasov, Romania, pp. 68-71.
- Heinsohn R.J., Kabel R.L. (1999). Sources and Control of Air Pollution, Prentice Hall, Upper Saddle River, NJ, 696 pp.
- Ionel I. (1994). Measuring emissions from flue gases using electrolytic sensors, *The National Conference of Thermodynamics*, Romania, vol. I, pp. 231-235.
- Lailer P.C., Dahiya S.S., Lal D., Chauhan T.R. (2005). Complete feed for livestock concept, present status and future trend, *The Indian journal of animal sciences*, vol. 75, pp. 84–91.
- Mihaila C. (2001). Industrial drying processes and installations, Technical Publishing House, Romania, pp 59-61.
- Roden C. A., Bond T. C., Conway S., Pinel A. B., MacCarty N., Still D. (2006). Laboratory and field investigations of particulate and carbon monoxide emissions from traditional and improved cookstoves, *Environmental Science and Technology*, Vol. 40/21, pp 6750–6757.
- Șara A., Odagiu A. (2005). Fodder quality control. AcademicPres Publishing House, Romania, pp. 52-58.
- Vasile C. (2018). Studies about the automated control of steam temperature in the forming mold of the combined feed granules in view of environmental protection, *Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series*, Vol. 48/2, pp. 425-430.

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 PENZA 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

Ação microbiológica 2
Adriatic Sea 150, 151, 152, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163
Agricultura agroecológica 20, 105
Agricultura familiar 105, 106, 107
Agricultura orgânica 83
Agroecologia 2, 3, 19, 20, 91, 122
Aislamiento social 134, 135
Anisotropy ratio 72, 73, 75, 76, 77, 79, 80
Antioxidantes 2, 10, 12, 16, 20
Arachis hypogaea L. 30, 31, 39, 40
Automation 21, 28

B

Bioecology of Bactrocera zonata 92
Bioestimulante 2, 3, 4, 6, 7, 8, 15, 16, 17, 128
Biology 51, 70, 92, 94, 95, 150, 151, 152, 154, 155, 158, 159, 163, 164
Biomasa 31, 37, 38, 42, 43, 45, 46, 48, 49, 50
Biossolução 2
Bluefin tuna 150, 151, 152, 156, 159, 160, 161, 162, 163, 164
Brote 124, 127
Buenas prácticas 165, 166, 167, 168, 170, 171, 173, 184, 185, 186, 187

C

Combined feeds 21, 22, 26, 28
Comportamiento sexual 134, 135

D

Densidad Kernel 53, 55, 58, 60
Density 54, 62, 72, 73, 74, 75, 76, 77, 78, 79, 80, 106
Dermatofitos 139, 140, 141, 143, 144
Despunte 124, 127
Diversidad genética 64, 65, 66, 67, 68, 69, 70, 71

E

Enseñanza - aprendizaje 165
Environment 21, 22, 39, 152, 159, 160, 161
Esporotricosis 139, 141, 142, 143, 145, 147
Estructura 124, 125, 168

F

Fishing 150, 151, 152, 153, 154, 155, 156, 158, 159, 160, 161, 162, 163
Fomento 53, 60
Fotoestimulación 134

H

Hortaliça de raíz 83
Hybridization of Bactrocera species 92

I

Interconexión en cultivos 31
Invasive species management 92

M

Machos cabríos 134, 135
Maíces occidentales 31
Manejo agronómico 123, 124, 125, 126, 129, 132
Mascotas 139, 145
Máxima entropía 53, 56, 57, 58
Mejoramiento genético forestal 64, 65
Micosis 139, 140, 141, 142, 143, 147

N

Niveles de humedad 42, 43, 44, 49, 50
Noxious emissions 21

P

Peach fruit fly 92, 93, 94, 95, 103
Pinus oocarpa 53, 54, 60, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 80
Planta espontânea 83

Producción 30, 32, 36, 38, 39, 42, 43, 45, 46, 49, 50, 51, 52, 63, 64, 65, 66, 67, 68, 69, 70, 126, 131, 132, 165, 166, 167, 168, 169, 172, 173, 175, 178, 179, 182, 183, 184, 185, 186, 187

Producción de resina 64, 65, 66, 67, 68, 69, 70

R

Reproducción animal 134, 137, 166

Restauración 53, 54, 60

S

Shrinkage 72, 73, 75, 76, 77, 78, 79, 81

Spatiotemporal distribution 92

Studies 2, 22, 29, 51, 93, 98, 150, 152, 154, 155, 156, 157, 158, 159, 160, 161

T

Testosterona plasmática 134, 135, 136, 137

V

Vinculación 165, 167, 169, 184, 187

Z

Zea mays 30, 31, 39, 40, 43, 51, 104, 105, 106, 109, 111, 112, 115, 116, 117, 118, 122