

Innovation in the field of agricultural machinery in the context of sustainable agriculture

Abstract

The habilitation thesis entitled "Innovation in the field of agricultural machinery in the context of sustainable agriculture" contains the results of my academic, scientific, and publishing activity in the field of exploitation agricultural machinery. The presented results fall within the time interval between the period of elaboration and defense of the doctoral thesis, the year 2008 and until now. According to the requirements of the Doctoral School of Agricultural and Engineering Sciences within USAMV Cluj-Napoca, the habilitation thesis is structured in three parts.

The habilitation thesis is structured in three main chapters: 1 Academic Achievements, 2 Scientific Research Activity and 3. Career evolution and development plans.

In Chapter 1 **Academic Achievements** is presented professional training, as well as teaching, scientific, and publishing activities from the presentation of the doctoral thesis to the present.

The didactic activity from 2002-2021 was carried out within the discipline of Agricultural Machinery, Department I Technical Sciences and Soil Sciences within the Faculty of Agriculture of the University of Agricultural Sciences and Veterinary Medicine from Cluj-Napoca. The didactic activity has been constantly improved through a series of postgraduate specializations, among which: Postgraduate scholarship within the European Program "Socrates-Erasmus" at the Institute of Mechanization, Hohenheim University, Stuttgart, Germany, Mobility Socrates Erasmus teacher (TS), a number of 8 internships; Specialization internships - research at Hohenheim University Stuttgart, 2000- until now; Research internships Lechler Company, Metzingen, Germany; Courses for maintenance and operation of forage harvesters, 2008, 2009, Krone Company, Spelle, Germany Course for the operation of grain drying facilities, 2010, Mepu Company, Finland and Training and improvement courses, use and programming of process computers for FNCs, Himel company, 2004- until now.

The publishing activity resulting from the didactic and research activity carried out during the 24 years materialized through the publication as first author or co-author of a number of 143 scientific articles, out of which 31 ISI indexed papers (5 ISI indexed and 26 ISI Proceedings) and 72 papers indexed in international databases (BDI).

Chapter 2 **The scientific research activity** of the habilitation thesis includes the description of the results obtained from the research activity carried out after obtaining the title of Doctor in 2008. The research was carried out under research contracts with teams from USAMV Cluj-Napoca and various collaborators (Himmel, Tehnofavorit, etc.). The research carried out during this period was divided into four main research directions:

Soil tillage, direct sowing, and conservative technologies

- Sustainable pesticide application techniques
- Innovative technologies for feed processing
- Innovative methods of fertilizer application

Research on tillage, direct sowing, and conservative technologies has focused on research on direct sowing, the influence of disc shape on direct sowing, the main advantages of the E-drive system used for precision sowing, and the influence of No-tillage systems on the soil. The results presented are regarding the resistance to soil penetration and the influence of the disc geometry in the sowing process.

Research on sustainable pesticide application techniques has focused on research conducted within the TOPPS projects. TOPPS projects were started in 2005 with a three-year project funded by the Life and ECPA programs, which focused on reducing the loss of plant protection substances in water from point sources of pollution. The TOPPS-eos project (2010) evaluated the available technologies in terms of their contribution to the optimization of plant protection machines so that the impact on the environment is as low as possible. The next project, TOPPS prowadis (2011-2014), is aimed at studying the reduction of the impact of diffuse sources of environmental pollution. TOPPS prowadis is funded by the ECPA, has 14 partners and is implemented in seven EU countries.

In the third Research direction, Innovative technologies for feed processing were presented results on Experimental tests on qualitative working and energy indices of the U-445 + GMD – 44 aggregate, as well as results on Optimizing the technological flow in feed kitchens by computer automation.

The fourth research direction Innovative methods of fertilizer application include research conducted within the project Eco-nano-technologies and intelligent equipment for mapping soil properties and evaluation in plant dynamics, in order to streamline agricultural production and environmental protection.

Chapter 3 **Career development and development plans** present a teaching and research career development plan. In order to develop teaching skills, it is necessary for the pedagogical development to be continuous, and the accumulation of information specific to the field will be achieved by collaborating with specialized institutions at the national level but also by collaborating with international partners.

In order to develop and improve teaching activities, both theoretical and practical, are proposed directions such as: continuous development of pedagogical skills by approaching and integrating modern communication techniques to facilitate the transfer of information, needed to teach both courses and laboratory work; Practicing teaching activities that focus on the student, so that the activities are as interactive as possible to maintain the attention of students, and other such methods.
