

Retrospective and Perspectives of Teaching in Machinery, Automation, Mechatronics, and Agricultural Robotics in Mexico

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Abstract

Mexico, as well as 17 countries in Latin America and the Caribbean, is a net importer of food, although it is an agri-food power, said the United Nations Food and Agriculture Organization (FAO) [1] and stressed that the region is in a position to self- And accelerate the fight for the eradication of hunger. Mexico's annual food imports, according to the study, exceeded its exports by \$ 3.363 billion on average between 2010 and 2012. Both man and animals provide almost no value as primary sources of power. As a result of this growing food shortage and the evidence that only equipment and machinery can increase productivity drastically, teaching on mechatronics and agricultural machinery takes on a strategically important and relevant importance. This work describes the beginnings, the current situation and the path and direction that this teaching should take.

Keywords: *Retrospective; Perspectives; Machinery; Automation; Mechatronics; Agricultural Robotics; Mexico*

Retrospective

It is until the end of the eighties that four educational institutions begin teaching in agricultural mechanization at the bachelor's level being: In 1976 the National Autonomous University of Mexico, created the Agricultural Engineer career with guidance in agricultural mechanics. The Antonio Narro Autonomous Agrarian University in 1979 approves the creation of the specialty of agricultural machinery, although the original project was the creation of a new career that had the title of degree in agricultural machinery with three specialties; Design, maintenance and administration. In 1983, the first generation of the Agricultural Engineer specializes in agricultural machinery, which changed its name in 1995 to Agricultural Mechanical Engineer [2]. The University of Guanajuato from 1980, created the Educational Program of Agricultural Mechanical Engineer and began its activities as part of the Faculty of Electrical and Electronic Mechanical Engineering (FIMEE) in Salamanca Guanajuato. The Autonomous University of Morelos with the career of Engineer in Agricultural Mechanization although in the late nineties it was canceled [2].

The Chapingo Autonomous University in 1983 began with the career of Agricultural Engineer specializing in Agricultural Machinery and in 1986 the first generation of Agricultural Engineers Specialists in Agricultural Machinery graduated, being this university the last to introduce the specialty of agricultural machinery in agricultural universities, and On September 25, 1991 the name of the degree of the race is changed, from Agricultural Engineer specialized in Agricultural Machinery to Agricultural Mechanical Engineer [3].

The Graduate College began teaching and research in 1996, with the creation of the first postgraduate degree in Agricultural Machinery in Mexico at the Master's level. Although currently suspended due to lack of income. Since from its creation until 2003 only 11 students

entered. Done because the government did not support the budget for scholarships and research because they show that they are not interested in the development of the mechanization of the country.

Likewise, in the 1970s, education began in the area of agricultural machinery at the high school level in some campuses of the National College of Technical Professional Education (CONALEP) with the terminal careers of Technical Professional in Agricultural Machinery and Technical Professional in Maintenance of Agricultural Machinery, and of some Centers of Agricultural Technological High School (CEBETas) with the dual studies of Technical Bachelor in Agricultural Machinery. And at present there is no teaching in the upper middle level of agricultural machinery and mechanization [4].

Current situation

Specifically, the teaching of agricultural machinery and mechatronics is taught in different institutions and in some of them several orientations are handled.

Currently, the Papaloapan University (UNPA) offers a career in Tropical Agricultural Engineering which has a certain orientation towards agricultural mechanization [5].

The FES Cuautitlán of the National Autonomous University of Mexico (UNAM), teaches the Agricultural Engineering career with some subjects on agricultural mechanization [6].

Likewise, three Universities have degrees in Agricultural Engineering related to mechatronics and agricultural machinery; Antonio Narro Autonomous Agrarian University (agricultural mechanical engineer, irrigation engineer, food science and technology engineer); Chapingo Autonomous University (agricultural mechanical engineer, irrigation engineer, agribusiness engineer, mechatronic agricultural engineer), University of Guanajuato (Agricultural mechanical engineering).

At the post-graduate level, the Doctorate and Master's Degree in Agricultural Engineering and Integral Water Use is taught at the Autonomous University of Chapingo [7].

The Master's Degree and Doctorate in Agricultural Production Systems Engineering is taught at the Antonio Narro Autonomous Agrarian University. In which with the investigation line of Management and use of soil and energy water, issues about mechanization and agricultural machinery are considered [8].

The Master's and Doctorate in Biosystems is taught at the University of Guanajuato. Having the orientation in Agricultural Mechanization. The Doctorate in Biosciences has been divided into five areas and/or lines of knowledge generation, among which Biotechnology, Agriculture and Agriculture stand out. Various research projects have been developed in these areas.

In the Autonomous University of Querétaro, the Master and Doctorate in Biosystems is taught. The objectives of this postgraduate course are: Prepare academic and scientific personnel with the capacity to solve specialized problems, by applying current engineering techniques to the productive sector and with the possibility of teaching, training and research in the management of bio-resources [9,10].

As far as agricultural mechatronics has been concerned since 2015, there has been concern about a career in agricultural mechatronics engineering, and this branch of engineering was proposed [11]. The only institution that echoed this concern of this researcher was the Chapingo Autonomous University creating the Agricultural Mechatronics Engineering degree in September 2017.

Currently, Automation of agriculture in our agriculture is becoming important; In the Technological University of southern Morelos, Technological University of Etchojoa, Technological University of the Southwest of Guanajuato, Linares Technological University,

Technological University of Mayab, Technological University of Escuinapa, Technological University of Candelaria; the subjects of Greenhouse Automation and Agricultural Automation are taught in the Sustainable and Protected Agricultural Engineering course.

Likewise, the career of Engineering in Agricultural Design and Automation is taught at the Ciudad Juárez Autonomous University [12].

Prospects

By the other hand, there was about a century of delay in teaching agricultural mechanization if it is taken as a reference to the United States of America, which is one of the most mechanized countries in the world in which Iowa State University (leading university in agricultural engineering in the US) began teaching in agricultural engineering in 1906 - 1907 at the bachelor's level, in 1918 at the Master's level and in 1938 the PhD program [4].

Keep in mind that modern agricultural machinery is complex and there is an opinion that at the mechanical level the limit has been reached conditioned by the raw materials used, but electronic development has just begun, and communication between machines will lead to authentic agriculture of precision, which demands a great qualification of the personnel in charge of the exploitation and maintenance of the working capacity of the machines, capable of reconciling all the factors that determine the success of their work [13].

The areas where the Agricultural Engineer is affecting is in systems and processes controlled by microprocessors and automated principles in the management of water, machinery and agroindustry (Automation and Robotics). The robotic systems will be the order of the day for all processes of agricultural production, where from the conception of agricultural machinery to its maintenance, it must be carried out efficiently [14]. Modernity in international agriculture is given by the application of precision agriculture and automation, these applications are basically based on mechatronics. Therefore, the educational perspectives of agricultural mechanics and machinery are quite interesting and necessary for the development of agriculture in our country, so it must be quickly migrated to the teaching of the agricultural mechatronics branch since the conditions are given. so that the development of this new specialty of Agricultural Engineering because the agriculture of the country is a fertile field so that it has an extraordinary development [9,15-17]. There is an infinitely extensive field for engineers agricultural mechatronics, so that other universities with lines of research in mechatronics should be incorporated into the application of this branch of engineering to agriculture, livestock, beekeeping, in addition to other universities such as the Antonio Narro Autonomous Agrarian University, The University of Guanajuato, The National Autonomous University of Mexico that pioneered the teaching n of education in Agricultural Machinery and Mechanics should not be left behind in teaching and research in this profession of the future.

In the area of Agricultural Automation at the bachelor's level the educational process has already begun, but it must be started and strengthened at the postgraduate level (master's and doctorate), same situation and opportunities for the afore mentioned universities.

As far as Agricultural Robotics is concerned, the situation is similar to that of agricultural mechatronics [18] has proposed this line of research and teaching, because there are several institutions with human and physical infrastructure in the country to enter this field, only The decision to start them is missing [19-26].

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