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# The Postgraduate Course in Tropical Agroecosystems: Facing the Challenges for Mexican Agriculture in the 21st Century

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## ABSTRACT

**Objective:** To analyze the contemporary scientific contributions of the Postgraduate Course in Tropical Agroecosystems (PTA), both in Master's and PhD Degree, of Colegio de Postgraduados, Veracruz Campus, before the current challenges facing the Mexican agriculture.

**Design/Methodology/Scope:** A search was made in SCOPUS and Web of Science for publications between 2014 and 2019 (N = 92) by PTA researcher scholars. A text analysis was performed by using the Nvivo software in order to identify scientific contributions based on the problem categories suggested by FAO for Mexico.

**Results:** Scientific contributions are more prolific in relation to the increase of agricultural productivity (66%), have lesser presence in sustainable practices (14.9%) and the articulation of public policies (10.6%) and begin to appear in the adaptation and mitigation of climatic risks (8.5%).

**Limitations/Implications:** The findings excluded publications that do not appear in SCOPUS or Web of Science or outside the analyzed period.

**Findings/Conclusions:** The PTA shows social relevance when generating knowledge, with scientific contributions to the current challenges of Mexican agriculture. Nevertheless, they have been oriented mainly to increasing agricultural productivity without attaining the risks of PTA toward transdisciplinary research processes. This suggests a new role of research that addresses disciplinary interfaces.

**Keywords:** Mexican agriculture, scientific contributions, system approach, institutional impact, social significance of the postgraduate course.

## INTRODUCTION

Society expects that postgraduate courses perform complex functions, such as the generation of knowledge, training of creators, thinkers, professionals, researchers and leaders for social, economic and political development (Cardoso & Cerecedo, 2011). They are a strategic element for



the development of scientific competences, reason why an indicator of their quality are the scientific contributions published in high-impact magazines with useful knowledge (Ortega *et al.*, 2017). In Mexico, these contributions have a high weight in order to belong to the National Quality Postgraduate Program (Programa Nacional de Posgrados de Calidad, PNPC), of the National Committee of Science and Technology (Consejo Nacional de Ciencia y Tecnología, Conacyt); for the agricultural and rural sectors, the postgraduate courses are aimed at providing guidelines that allow the government to set the public agricultural policy to cooperate in the solution for its problems (Reyes & Reyes, 2018). In this context, the objective of this work was to analyze the contemporary scientific contributions of the Postgraduate Course in Tropical Agroecosystems (PTA) both at Master's degree and PhD.

### Origin and Evolution of the Postgraduate Course in Tropical Agroecosystems

In 1993, the Veracruz Campus began the Master's Degree in Tropical Agroecosystem Sciences, based on a diagnosis, forecast and prospective for tropical agriculture in Mexico; the PhD in Sciences was incorporated in 1994. Before the program, there were research lines, some of which were addressed individually by the researchers. In 2001, research lines that were aligned with social and scientific trends on the handling of natural resources and production of foodstuffs were implemented, and this resulted in a robust program development. The educational scopes of students should be both national and international; the PTA has fostered the agroecological focus for the analysis of agroecosystems (AES) and an integrated agricultural perspective. In 2014, their knowledge generation and/or application lines (Lineas de Generación y Aplicación del Conocimiento, LGAC) were addressed at three levels: a) agroecosystems and their relationships with the territory, b) processes and interactions in the handling of AES and c) self-regulated ecological processes. Today there are three lines: 1) Assessment and Re-Design of Agroecosystems (ARAES), 2) Tropical Agroalimentary and Agroindustrial Chains (TAAC), and 3) Natural Resources, Agroecosystems and Climate Change (NRACC). The postgraduate course seeks to develop capacities under the competence focus in order to apply and transfer knowledge in productive units, under an integrated focus of agricultural and natural resources use, with interdisciplinary participation (CP, 2017).

### Agroecology: Disciplinary Framework of Agroecosystems

Since the beginning, PTA professors considered the agroecosystem to be their unit of study and as a scientific discipline of agroecology (Martínez *et al.*, 2011; Ruíz, 2006). Agroecology is an approach for understanding the ecological principles of traditional agricultural systems and to define, classify and study these systems from an ecological and socioeconomic perspective (Altieri, 1989; Méndez *et al.*, 2013). Agroecology stopped seeing the field or plot scale (1930-1960) and began the perception of an agroecosystem (1970-2000) (Wezel *et al.*, 2009; Wezel & Jauneau, 2011); the PTA was consolidated in this last period. The study of agroecosystems initially considered the components and functions of natural ecosystems, including local knowledge and production strategies based on ecological principles (ecological handling of plagues, association of crops and agroforestry systems (Altieri *et al.*, 1999; Argüello, 2015; Gliessman, 2011). Currently the agroecosystem is studied as a unit of analysis from the systems approach; it considers both ecology, social and political aspects in the context of decision-makers (farmers) (Gallardo *et al.*, 2018); together with this growth in intention (qualitative) and extension (qualitative) of agroecology and its unit of study, the PTA has co-evolved as a response to the complexity of social demands.

### MATERIALS AND METHODS

A query was made on the SCOPUS and Web of Science databases in February 2020, with the name of each PTA researcher; the last 5 years were considered (2014-2019). SCOPUS gave 138 scientific papers and Web of Science gave 101; upon suppressing repeated papers there were 92 papers left. In both databases information on 23 researchers was found from a total of 28 PTA professors. The final database had the name of the author, the publication, the magazine, volume, issue and publishing year. A Word file with the title, year, abstract, keywords and conclusions was created for each document. A text analysis of these documents (Gallardo *et al.*, 2018; Gallardo *et al.*, 2019) was made by analysis category of challenges for Mexican agriculture set in advance according to FAO's classification (2018): 1) effective alternatives to adapt and mitigate climate risks, 2) sustainable practices in the handling of natural resources, 3) knowledge and practice of indigenous communities and 4) articulation of public social protection and economic development policies that leverage an integrated human development. The NVivo





and forage, citrus fruits and energy crops (Aguas *et al.*, 2014; Alamilla *et al.*, 2016; Andrés *et al.*, 2017; Calzada *et al.*, 2014; Espinosa *et al.*, 2018; García *et al.*, 2016; García *et al.*, 2019; Grifaldo *et al.*, 2019; Guillén *et al.*, 2018; Gutiérrez *et al.*, 2018; Hernández *et al.*, 2015; Hernández *et al.*, 2016; Hernández *et al.*, 2018; Hernández *et al.*, 2019; Ibarra *et al.*, 2018a; Ibarra *et al.*, 2018b; Jaimez *et al.*, 2015; José *et al.*, 2017; Mendoza *et al.*, 2019; Mendoza *et al.*, 2015; Pérez *et al.*, 2016; Rueda *et al.*, 2016; Rueda *et al.*, 2018; Sánchez *et al.*, 2018; Valdes and Pérez, 2019; Villanueva *et al.*, 2019).

The current PTA challenges suggest that the subject matter of the study and generation of knowledge integrate experiences of stakeholders in a transdisciplinary research process (CP, 2017). Nevertheless, the results show scientific contributions oriented to increasing productivity, in congruency with the development of scientific research in the last 60 years that fosters a highly productive and profitable agriculture, although with environmental and social consequences (Sarandón, 2019). Similar studies are centered under the perspective of social relevance without considering scientific contributions like this work does, although with similar results, reflections and conclusions. Garrocho & Lazcano (2012) explored the social relevance of scientific research projects of Universidad Autónoma del Estado de México; these evidence the need of a more integrated academic structure centered on social relevance criteria that guarantee a sustained progress of knowledge areas, but which mainly contribute to reaffirming the commitment of scientific communities with their social environment. In the state of Chihuahua, Hernández *et al.* (2017) suggested orienting the training of researchers in a curriculum design that is congruent with the context in order to respond to real needs. As for postgraduate degrees in Universidad Autónoma de Nuevo León, Duéñez *et al.* (2018) considered that the relevance in education should be reviewed constantly and this allows changes in policies toward a contemporary education, such as reinforcing research competences for the design and implementation of innovative projects. This analysis on the scientific contributions of PTA and its contribution before the challenges of Mexican agriculture are the background for re-thinking our research, as the current administration points to a development model that prioritizes emergent social and economic issues to attain human wellbeing and development (Muñoz, 2019).

## CONCLUSIONS

Publications generated from 2014 to 2019 by postgraduate course Tropical Agroecosystems researchers show that the research is oriented mainly to an increase in agricultural productivity, with low social relevance, according to the main challenges identified by FAO. This shows contributions with respect to sustainable practices and the articulation of public policies; initial contributions to the adaptation and mitigation of climate risks, although there were no contributions from the knowledge and practice of indigenous communities. This also suggests laying down a new role for the research of the program to address complex contemporary challenges and disciplinary interfaces with a transdisciplinary trend.

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