

# MENDIVE



## REVISTA DE EDUCACIÓN

Translated from the original in Spanish

### Original article

## Chemistry and soil resource protection in the training of Media Technicians in Agronomy

### La Química y la protección del recurso suelo en la formación del Técnico Medio en Agronomía

### Proteção de recursos de Química e solo na formação de Técnicos de Mídia em Agronomia

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### ABSTRACT

In the training of middle technicians in Agronomy, chemistry plays a decisive role, since for agricultural production much use is made of chemicals that are used as fertilizers and pesticides, and to regulate plant growth, in search of high agricultural and livestock yields. In this sense, the authors propose professional teaching tasks to influence the environmental education of students in the career of Agronomy, Media Technicians, at the "Guillermón Moncada" polytechnic center, in the municipality of Urbano Noris, with emphasis on the protection of the resource soil, from the teaching of Chemistry as a subject and as content in agronomic subjects. These tasks are focused from the theoretical and practical classes in the field, the main research material, supported by the experimental method of research, as well as didactic methods, including joint development and independent work. A pedagogical experiment is used. The professional teaching tasks are developed in the subjects: Chemistry, Agricultural Production, Agricultural Health, Irrigation and Drainage, Integrated Soil Management and Animal Husbandry-Veterinary. The initial diagnosis (teachers, students, teaching-professional process), the implementation of professional teaching tasks, and the subsequent measurement of their impact on the training of professionals in the field of soil resource protection, offer scientific results that strengthen students and teachers in their professional performance with adherence to environmental respect, and with this the objective of this research is considered fulfilled.

**Keywords:** Agronomy; environmental education; environment; Chemistry; agricultural soil.

## RESUMEN

En la formación del Técnico Medio en Agronomía, la Química interviene de manera decisiva, pues para la producción agrícola se recurre mucho a los productos químicos que se utilizan como fertilizantes y plaguicidas, y para regular el crecimiento de las plantas, en busca de altos rendimientos agrícolas y ganaderos. En este sentido, los autores proponen tareas docentes profesionales para incidir en la educación ambiental de los estudiantes de la carrera de Agronomía, Técnico Medio, en el Centro Politécnico "Guillermón Moncada", del municipio de Urbano Noris, con énfasis en la protección del recurso suelo, desde la enseñanza de la Química como asignatura y como contenido en las asignaturas agronómicas. Estas tareas se enfocan desde lo teórico y las clases prácticas en el campo, principal material de la investigación, apoyadas en el método experimental de esta, así como en los métodos didácticos, entre ellos: la elaboración conjunta y el trabajo independiente. Se utiliza un experimento pedagógico. Las tareas docentes profesionales se desarrollan en las asignaturas: Química, Producción Agropecuaria, Sanidad Agropecuaria, Riego y Drenaje, Manejo Integrado de los Suelos y Zootecnia-Veterinaria. El diagnóstico inicial (profesores, estudiantes, proceso docente-profesional), la implementación de las tareas docentes profesionales y la posterior medición de su impacto en la formación del profesional en el ámbito de la protección del recurso suelo, ofrecen resultados científicos que fortalecen a estudiantes y profesores en su desempeño profesional, con apego al respeto ambiental; con ello se da por cumplido el objetivo de la presente investigación.

**Palabras clave:** Agronomía; educación ambiental; Medio Ambiente; Química; suelo agrícola.

## RESUMO

Na formação de técnicos médios em Agronomia, a química desempenha um papel decisivo, uma vez que para a produção agrícola se faz muito uso de produtos químicos utilizados como fertilizantes e pesticidas, e para regular o crescimento das plantas, em busca de altos rendimentos agrícolas e pecuários. Nesse sentido, os autores propõem tarefas docentes profissionais para influenciar a educação ambiental dos alunos na carreira de Agronomia, Técnicos de Mídia, no centro politécnico "Guillermón Moncada", no município de Urbano Noris, com ênfase na proteção do recurso solo, a partir do ensino de Química como disciplina e como conteúdo em disciplinas agrônômicas. Estas tarefas centram-se desde as aulas teóricas e práticas no terreno, o material principal de investigação, suportado pelo método experimental de investigação, bem como os métodos didáticos, incluindo o desenvolvimento conjunto e o trabalho autónomo. Um experimento pedagógico é usado. As tarefas de ensino profissional são desenvolvidas nas disciplinas: Química, Produção Agropecuária, Sanidade Agropecuária, Irrigação e Drenagem, Manejo Integrado do Solo e Pecuária-Veterinária. O diagnóstico inicial (professores, alunos, processo ensino-profissional), a implementação de tarefas docentes profissionais e a subsequente medição do seu impacto na formação de profissionais na área da proteção dos recursos do solo, oferecem resultados científicos que fortalecem alunos e professores na sua atuação profissional com aderência ao respeito ao meio ambiente, e com isso considera-se cumprido o objetivo desta pesquisa.

**Palavras-chave:** Agronomia; educação ambiental; Meio Ambiente; Química; solo agrícola.

## INTRODUCTION

Since ancient times, human beings have been concerned with protecting the environment. However, efforts have not prevented its deterioration to alarming levels. All human activities have had a negative impact on the natural environment; however, it is agriculture that has most damaged terrestrial and aquatic ecosystems. In its beginnings, thousands of years ago, agriculture was subsistence, and over time technologies were introduced to increase production, in order to meet the demand for food. The scientific-technical boom in agriculture has caused serious damage to soils and forests, since the intensity of tillage is very invasive.

Faced with this reality, it is urgent to educate the entire population for a correct relationship with the Environment, but it becomes more important when it comes to the training of professionals in the agricultural and livestock field (Mined, 2012). Optimum job performance is expected from these professionals, which goes through scientific-technical innovation, and a high environmental culture.

The actions aimed at the protection of the soil resource constitute essential pillars of the sustainable development to which Cuba aspires, and support the strategy of the National Program for the Conservation and Improvement of Soils, which has been implemented since the year 2000; but a greater effort is still required to be able to reverse the serious problems that soils present at the national level. Although it is considered that all the measures implemented have allowed interference in the development of the main degradation processes, the environmental problem continues to be very complex (Citma, 2016). This same source of information specifies the main problems that soils present: erosion, poor drainage, low organic matter content, low moisture retention, compaction, salinity

and sodicity, stoniness or acidity. These are the problems that should be a source of debate and instruction in the Cuban school classroom, but mainly in agricultural polytechnic centers.

Naturally, soil is the most important resource for an agricultural professional. This natural resource is seriously damaged worldwide, and in Cuba it shows a worrying deterioration, since 75% is categorized as low productivity (Citma, 2016). In the Urbano Noris region there is a high salinity in the soils, which has a negative impact on the sugarcane vegetation, specifically at - 88.44% (García, Villazón and González, 2021).

Consequently, with the socioeconomic reality of the municipality of Urbano Noris, current and future agricultural workers have to make use of cheaper and less industrialized alternatives to fertilize the soil. Among these alternatives are organic fertilizers, since they have different beneficial effects on the physical properties of the soil, improve the structure, decrease apparent density, increase porosity, aeration and infiltration and water retention; it decreases surface runoff of water, increases the stability of aggregates and prevents soil erosion (Trinidad Santos and Velasco, 2016).

In the municipality where the polytechnic center is located, numerous studies have been carried out on soils and agricultural sciences, in a general sense, whose contributions must be managed from the teaching of Chemistry and other subjects, since the contents produced by the investigations enrich the curricular contents, with which it allows presenting recommendations for an integral agronomic management of the soils according to the chemical properties, directed fundamentally to the use of nutritional variants (Cobo, Angarica, Martín, Villazón & Serrano, 2015).

Therefore, it is urgent to take care of them and use them sustainably. This purpose is achieved through the acquisition of significant agricultural and environmental knowledge, coupled with a deep awareness that generates environmental values and attitudes. Towards this goal the authors of this paper have put their professional and human efforts.

One of the aspects that receives the most attention in the training of the Intermediate Technician in Agronomy, is that related to organic matter and fertilizers in agricultural soils, whose object is part of the body of knowledge of Agroecology. But not only this discipline has the task of consolidating agrotechnical knowledge; rather, the remaining subjects in the curriculum have a duty to make significant contributions. Agricultural production cannot be alien to the agricultural education of workers, whose theoretical and methodological framework is supported by a group of authors from Cuba (Santos *et al*, 2011).

Environmental problems related to soils are not exclusive to Cuba or the province of Holguín, but also to Latin America and other regions of the world. Various authors and institutional reports recognize the consequences that the main degrading processes bring to agriculture, including soil erosion, depletion and salinization (Glico, 2020; UN, 2020; Sánchez, 2020), leaving millions of people in a state of food and environmental vulnerability, whose panorama emerges in deaths and desolation. Very eloquently, the Inter-American Institute for Cooperation on Agriculture (IICA) makes an inescapable call: "it is urgent to reverse degradation trends, changing the management dynamics of soils, forests and agroecosystems to increase soil fertility, reduce erosion, increase biodiversity, favor water retention and avoid deforestation" (IICA, Witkowski, 2019, p. 47). The reflection that the teacher promotes through the Teaching-Learning Process can contribute to

better soil management by agricultural workers.

The horizon pursued by this educational research is that of agricultural sustainability, a social demand for many years, whose achievement faces a complexity that has dimensionality expressed in the environmental, social and economic aspects (González, Machín & Galán, 2018). Concatenating these three dimensions is of great interest to pedagogy, whose pragmatism cannot ignore the scientific-technical advances that prevail in agriculture.

The initial diagnosis made to the teaching-educational process of the specialty of Agronomy, Middle Technical level, teachers, taking into account the results achieved in the PIAL branch project "Strengthening of environmental education in the Polytechnic Center, located in the municipality of Urbano Noris of the province of Holguín", as well as the professional experience of the researchers on the subject, made it possible to verify that despite the improvement work in the study plans, and the transformations in the pedagogical practice, manifestations of that constitute obstacles in the training process in relation to the environmental training of these intermediate technicians, highlighting, among the most significant, the following:

- Limitations in the recognition of environmental problems and, consequently, with its importance in professional performance, both in students and in teachers and technicians of agricultural fields.
- Insufficiencies in the perception and understanding of the problems resulting from the degradation of the soil resource, manifested in negative behaviors during the execution of agro technical cultural practices.
- Lack of mastery of the problems of soil resource degradation in the

"Guillermón Moncada" Polytechnic Center.

- Insufficiencies in the appropriation and deepening of the chemical contents in the agricultural branch, which limits the contribution they can make with a view to the protection of the soil resource. It is evidenced in the test results and their projection.
- Insufficient influence of Chemistry, within the curriculum, in the environmental training of students; issue observed in lesson plans, methodological meetings and visits to classes.
- Scarce methodological work at the departmental level to project the environmental education of students, agricultural field technicians and teachers. The subject programs have multiple potentialities for environmental education aimed at the protection of the soil resource.

These insufficiencies show that students in initial training lack guidance and training in an environmental culture that allows them to protect the soil resource, conceived as a specific edge in the training of this Middle Technician in the specialty of Agronomy.

The subjects of natural sciences have remarkable potentialities to have a positive impact on the environmental training of an Agronomy professional, since the body of knowledge of the same offers possibilities and potentialities to develop in the students a deep feeling of love for nature, care and protection of its resources, from a more critical, analytical and participatory perspective.

Considering the reality described, and the need to transform it, the authors set themselves the objective: to develop professional teaching tasks that help students acquire knowledge and environmental values regarding the soil resource, which is fundamental for an

agronomist, from the teaching of content of chemistry and agronomic subjects.

Through this contribution, the training of intermediate technicians in Agronomy is favored because it is linked to the objectives of the Cuban State in terms of the State Plan to confront climate change, approved by the Council of Ministers on April 25, 2017 (Task Vida) (Citma, 2020), especially in the protection of the soil resource, which is seriously damaged in the region of the municipality of Urbano Noris, in the province of Holguín.

## MATERIALS AND METHODS

The methodology used has its essence in the application of a pedagogical experiment, very feasible in the conditions in which the research was carried out.

The generality of the authors considers the pedagogical experiment as the fundamental experimental method, the most complete and important in the process of scientific research. It has a complex character, because at different times of its realization other empathic methods are executed as sources of obtaining, as well as theoretical methods (from the very conception of the experiment to the interpretation and generalization of the results), and mathematical and statistical methods (Peña Ramos, 2020).

The entrance test consisted of carrying out a comprehensive diagnosis at the beginning of the school year, the essence of which was achieved with a pedagogical test, since "pedagogical tests are frequently used in pedagogical research with the aim of diagnosing the state of knowledge, habits and skills of the subjects at a given time" (Cerezal Mezquita, J. *et al.*, 2004).

The initial diagnosis was made by performing a mixed-type pedagogical entry test, which includes closed and open-ended questions. The contents determined to be measured were the following:

- Importance of soils in agriculture.
- Current situation of the soils in the municipality.
- Main problems faced by soils in the municipality.
- Agroecological methods for its conservation.
- Natural sciences in soil conservation.

In addition, the researchers systematically used scientific observation and document review.

The research used a sample of 25 students of the second year of the Agronomy career, of the Middle Level, at the "Guillermón Moncada" Polytechnic Center, in the municipality of Urbano Noris, in the province of Holguín. The implementation of professional teaching tasks occurred in the 2019-2020 school year.

The final diagnosis was based on a pedagogical exit test and the empirical methods of observation, whose objective was focused on the search for new knowledge in the students, including the skills to improve soils and the knowledge to make effective interventions in that area in the same sense.

Among the aspects included in this test are:

- Chemistry and its impact on the agricultural sector (positive and negative).
- The impact of pesticides and herbicides.
- The ecological methods used for agricultural health.
- The environmental values and attitudes that should characterize an agricultural worker.

- The impacts of climate change and actions for its mitigation.

## RESULTS

The initial diagnosis yielded results that allowed palpating a series of difficulties in the cognitive order of the students. The six areas of content, object of measurement, covered the fundamental nuclei on which the work of a Middle Technician in Agronomy rests. Unfortunately, 52% of the students were located at level I of knowledge (insufficient) because they offered very limited answers to topics such as the importance of soils in agriculture, the problems and perspectives of soils in their municipality of residence and the agroecology. In addition, they showed confusion about the contribution that natural sciences can make in the interdisciplinary study of soils.

With elementary knowledge on these topics, six students, 24%, were found to reach level II. The same number of students offered satisfactory answers, thus earning a placement in level III. A graphical representation of these results can be seen in Figure 1.

Faced with this initially adverse reality, the researchers wondered how to transform it from the interrelation of the contents of Chemistry with those of the agronomic sciences, which becomes the proposal of Professional Teaching Tasks (TDP). They were conceived based on the subjects Agricultural Production, Agricultural Health, Irrigation and Drainage, Integrated Soil Management, Fundamentals of Livestock Production and Zootechnics-Veterinary. Next, the potentialities of each of the technical subjects are briefly presented.

### **Agricultural production I, II, III (155 hours)**

It considers elements of botany and physiology, from characterizing the most important families and species of agriculture. It has innumerable potentialities to verify chemical knowledge applied to production.

### **Agricultural Health (62 hours)**

The knowledge provided by this subject is key to preventing pests and diseases.

Among those addressed are:

- Etiological agents producing pests and diseases in animals.
- Main biological agents that cause pests or diseases in plants and animals: viruses, fungi, parasites, rodents, mollusks.
- Chemical substances commonly used in agricultural health. Security measures. Exposure levels.

### **Irrigation and Drainage (31 hours)**

This subject provides the necessary knowledge that enables the student to solve practical and simple irrigation problems in an area of the agricultural company in different crops, at their level.

- Basic concepts of agro-meteorology, necessary for irrigation and drainage.
- Hydrophysical properties of soils.
- Water in irrigation: quality, origin and problems related to water.

### **Integrated Soil Management (93 hours)**

It studies, in general, the physical, chemical and biological phenomena that occur in the soil, as well as the tasks that can improve and preserve its properties, to achieve an adequate use and obtain better harvests.

- Soil colloid.
- The pH or reaction of the soil.
- Agrochemical sampling.
- Agrochemistry. Macroelements and microelements.
- The fertility of a soil.

### **Chemistry (93 hours)**

The Chemistry subject is of the utmost importance for professionals in agriculture. Agricultural Chemistry is the discipline that provides these professionals with the necessary knowledge to characterize agricultural soils, taking into account properties such as soil and plant nutrients, pH, the types of fertilizers to be used, all of which soil typologies.

- Chemical properties of soils.
- Soil colloid.
- Water properties.

Nine professional teaching tasks were elaborated and developed, which can be developed in classes and in agricultural practices. As an example, three of them are explained.

#### **Professional teaching task "Chemical characteristics of soils"**

- Subject that provides the content for the analysis: Chemistry.
- Objective: to sensitize students, teachers and technicians of agricultural fields about the advantages of applying organic matter in the improvement of agricultural soils.
- Learning situation.

In the UBPC "October 8" of the municipality of Urbano Noris, there is one hectare of sweet potato (*Ipomoea batatas*), and the administrator is instructed to harvest the crop. When executing the collection, low productions are observed; the soil is eroded, with cracks, which brought with it the

introduction of the Tetouan plague of sweet potatoes. In addition, there is an affectation on the ground. Faced with this situation, the technician suggests the application of earthworm humus to the administrator. Analyze and try to answer the following questions:

- a) What is the technician based on to make this suggestion?
- b) What is the study that the technician should have done?
- c) How important is earthworm humus for soils?
- d) What are the advantages offered by the application of this compound?
- e) Why are minerals in soils important?
- f) Go to the school library, request the corresponding bibliography and research the chemical elements that are present in the worm castings.
- g) Visit an agricultural area and observe how earthworm humus is made, ask the producers for their opinions about this soil rehabilitation technique.

- Procedure

- a) Guide the content and assurances of the professional teaching task for its realization in the form of five teams.
- b) They are offered 48 hours to complete it.
- c) In a class shift, selected by the teacher, the completion of the TDP is checked. To do this, offer a few minutes to each team to present what they have achieved.
- d) Establish a professional discussion around the solution of the task. Make the precisions required to strengthen the scientific

foundations about the state and conservation of soils, in addition to stimulating the use of organic fertilizers.

e) The teacher intervenes at the end to generalize and specify in case of errors.

- Evaluation

The evaluation of professional teaching tasks is developed independently through the different interventions of the students. A quantitative assessment is awarded on the basis of 10 points.

Once each student, individually, through professional discussion with the teacher, reflects on the solution to the questions asked, the collective assessment is carried out.

### **Professional teaching tasks "The impacts of water on soils"**

- Subject that provides the content for the analysis: Irrigation and Drainage.
- Objective: to delve into the impacts of irrigation water on soil quality.
- Learning situation.

Visit the sugar cane region of "Las Cuarenta", specifically a cane field that is being irrigated. Take into account the following aspects for your observation and dialogue with the producers and operators:

- a) Inquire about the hydro physical properties that are related to the irrigation of agricultural crops: field capacity, wilting point, bulk density, soil porosity, and rate of water infiltration into the soil.
- b) Ask about the field methods used for their determination.
- c) Obtain the necessary data to determine the rate of water infiltration into the soil.



Prepare the curves of infiltration and accumulated filtration.

d) Before visiting the agricultural area, study the following materials, which will be available in the school library, to learn about the environmental impact of irrigation water on agricultural soils. Why does irrigation water impoverish soils in the medium and long term? What volume of water is spent in Cuba for agricultural production?

e) Ask the cane producers and the irrigation operators what they know about the questions previously formulated, write down their criteria. Make corrections and offer alternatives in this regard. Be discreet and careful.

- Procedure

a) Guide the learning situation.

b) They are given a time of 15 days.

c) In the classroom or elsewhere, they proceed to listen to the results of the students in their research-oriented process.

d) Establish a professional debate around the solution of the task, promoting the development of the environmental and technological culture.

e) The teacher intervenes at the end to offer the conclusions and emphasize the environmental aspects in relation to water and its use in agriculture.

- Evaluation.

### **Professional teaching task "Physical properties of soils"**

- Subject that provides the content for the analysis: Integrated soil management.

- Objective: characterize the physical properties of the soil, taking into account the characteristics of the area and the alternatives for its use and conservation, based on the improvement of the environment and the soil.
- Learning situation.

Select an area of the cooperative where you carry out your professional practice, and sensory check the following:

a) The phases of the transformation of organic matter.

b) The amount of organic matter for a given area. To do this, you must perform the relevant calculations.

c) Propose the causes that have given rise to the current state of said soil.

Additionally, perform the following actions:

a) Participate in the manufacture of compost, together with the workers. Report on the procedure carried out.

b) Assess the current state of organic farming in the study region and propose the necessary measures to make it more effective.

c) Value the contribution that the natural sciences can make in the promotion of ecological agriculture.

- Procedure

a) Divide the group into four teams.

b) Orient the learning situation indicated in the teaching task to the students.

c) 48 hours are offered for completion.

d) Return to the classroom to establish a professional debate around the solution of the task, promoting the development of economic and technological culture.

e) The teacher intervenes at the end to generalize and specify in case of errors.

- Evaluation

After the development of the nine (9) professional teaching tasks, the students, individually, reflect on the solution of the questions and tasks formulated within the TDP. Simultaneously, the collective assessment is carried out, supported by a professional debate, led by the teacher. It is the ideal time to highlight the main instructional and educational content required by the training objective.

The evaluation of each student, in each professional teaching task, was assumed as a result of the final diagnosis.

The evaluation of professional teaching tasks is carried out independently, for which each one has an aspect called "evaluation". This evaluation consists of assessing what the student has achieved in terms of: performance of the assigned task in the field or in the library, answers given to the questions asked by the teacher at the time of presenting the results of the teaching-professional task, active participation in carrying out the actions of the tasks and during the debate in the classroom, attitude shown during the Teaching-Learning Process. A quantitative assessment is awarded on the basis of 10 points.

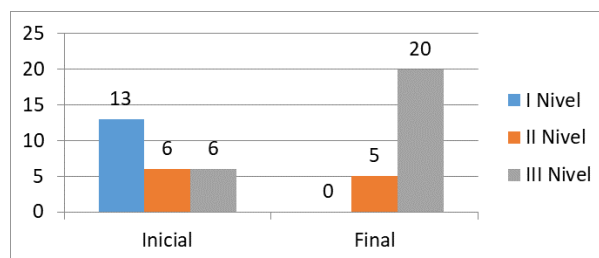
Both in the initial and in the final diagnosis, the students were placed in learning levels: level I, level II and level III.

**Level I** (Insufficient). Students who do not show significant knowledge about the Environment, and soils in particular, are located.

**Level II** (Elementary). Students who show basic knowledge about the Environment, and soils in particular, are located.

**Level III** (Adequate). Students who show significant knowledge about the Environment, and soils in particular, are located.

The comparison of both diagnoses generates data that can be comparable, as shown in the following graph:



**Graph 1-** Comparison of the results of the initial and final diagnosis

#### Initial diagnostic

Ø **Level I.** 13 students (for 52%) reached a first level of development.

Ø **Level II.** 6 students (for 24%) reached a second level of development.

Ø **Level III.** 6 students (24%) were located in the third level of development.

#### final diagnosis

Ø **Level I** No students were placed in level I.

Ø **Level II.** 5 students were located in the second level of knowledge, that is, 20%.

Ø **Level III.** 20 students reached the third level of knowledge; that is, 80%.

## DISCUSSION

The results achieved in this research are characterized by a high pedagogical and social relevance. In the pedagogical order, the didactics of the subjects with an agricultural profile are enriched, by establishing interdisciplinary with Chemistry to offer explanations for phenomena that are harmful to the soil, such as low fertility, salinization and sodicity. In this sense, there is no known background in the didactics of agricultural sciences at the middle level of Technical and Professional Education, nor research by teachers at this level of education. The social significance of the research is evident in the preparation of the Middle Agricultural Technician, which is needed by the municipality of Urbano Noris and others in the province, which favors the improvement of soils in an agricultural region that urgently demands a transformation in traditional agricultural practices.

The transformations are varied when it comes to research of a pedagogical nature, since each student and teacher corresponds to an evolution that is in correspondence with the degree of educational influence. The methodology, the didactics, and the results achieved, set an important guideline for future research in this field of Technical and Professional Education. The result may not be transcendent for a global teaching framework, but it is novel and of high practical significance for the municipality of Urbano Noris, with emphasis on the Polytechnic Center, since it strengthens its social relevance. In the present study, the transformations can be synthesized from some evidence:

- A change of mentality is appreciated in reference to the use and conservation of soils. A greater respect for the use of land is noted in the students, which is captured in the assessments they make in the face of

difficulties and the findings found in their pre-professional practice.

- The components of environmental education (knowledge, skills, awareness and sensitivity to the environment, values-attitudes) are reinforced with the development of professional teaching tasks, as students achieve a deeper understanding of environmental issues related to agricultural land, and have the tools to make informed and responsible decisions.
- Sensitivity to soil problems increased. In this sense, the concern for the problems presented by the soils is notable, mainly the scarce nutrients that characterize them and the high levels of salinity that they present.
- General knowledge about the Environment was deepened, with particular emphasis on soil and water. The very concern for the problems of soils and agriculture, in general, has led students to delve into the deeper study of those topics that affect the quality and improvement of soils. In a good part of them, there is an eagerness to know more, to protect and conserve more. Undoubtedly, this is a strength as a result.
- They developed cognitive procedures based on the interdisciplinary of natural sciences, to explain facts and phenomena of sustainable agro ecological agriculture. A quality resulting from the research is the change achieved in the students regarding the interdisciplinary role of issues on the use and exploitation of soils. Its conclusions are decisive in promoting the interdisciplinary vision that every professional in agriculture needs.
- For the first time, the Integrative Tasks subject incorporates Environmental issues, so that students investigate and propose solutions to various problems present in the municipality's agriculture. This

constitutes a novelty in research and in the Polytechnic Center itself. The integrative task is the subject that is responsible for guiding and evaluating the culmination of studies of these professionals. The review of all the integrating tasks of the last four years, showed that, in none of the cases, the themes of the Environment and agro ecological agriculture figured in the studies of the students, so their introduction is new for them. This is a research achievement.

Among the fundamental generalizations of the study, the following stand out:

- The professional teaching tasks offer a didactic conception with an interdisciplinary nature, which positively impacts the knowledge and motivations of the students towards the study of the soil resource, the backbone of the Middle Technician in Agronomy.
- The preparation of the strategy in the Middle Technician in Agronomy career assumed a set of elements that met the fundamental demands of this, which consisted in the determination of different interdisciplinary themes that facilitated the adequate organizational didactic work of the teacher, to establish the interdisciplinary of Chemistry, Physics, Biology and Geography.
- The professional teaching tasks had a notable impact on the motivation of the students, as well as on the enrichment of knowledge about soils and Chemistry, emphasizing water as a vital resource for agriculture.

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**Conflict of interest:**

Authors declare not to have any conflicts of interest.

**Authors' Contribution:**

The authors have participated in the writing of the work and analysis of the documents.



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