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Studies on Cultivation Practices as a form of Environmental Education and Sustainable Development

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Abstract

This work compiles sustainable agriculture methods such as hydroponics, crop rotation and family farming, as well as how cultivation can assist in the process of environmental education and sustainability. It was exposed how the relationship between agronomic activity and environmental preservation proposals is presented, in order to emphasize solutions that the agricultural sector adheres to sustainability. In this way we made the report of a case study, in which we tried to apply methods of cultivation of agronomy in the classroom. In this case study we promote the reuse of waste, we point out how the practice of cultivation helps to promote sustainable development and how important a planning that encompasses, not only students with a teacher, such as the community and the school.

Keywords: Soil; Environmental Education; Agriculture; Sustainable Development; Farming; Crops; Hydroponic System

Introduction

Agriculture is one of the main Brazilian economic activities consisting of a constant management of the environment, which can cause its degradation [1,2]. Reconciling agronomic growth with environmental conservation has been a challenge, considering that any inadequate management measure can have harmful consequences for the ecosystem and its biodiversity [3,4]. Sustainable initiatives have risen in order to make possible the reconciliation between agronomic development and the preservation of the environment.

Sustainable initiatives, sustainable development and sustainability are synonymous terms whose function is to promote practices based on three basic precepts: Economy, environment and society [5]. Joining the movement, sustainable agroindustry emerged with practices that soften environmental damage and contribute to the recovery of habitats, in addition to maintaining biodiversity [6,7]. Sustainable agronomy practices, such as hydroponics, which has a less impactful soil management, family farming, urbanization of crops through community and home gardens and especially environmental education [8,9]. Hence, one may see agriculture with a new purpose, that of preservation, driving sustainable development and environmental education.

In the matter of Brazilian education, environment is a theme that has been addressed in schools, supported by public policies through the Law of Directives and Bases (LDB) [10]. In addition, environmental education and sustainability are transversal issues of the BNCC, *Base Nacional Curricular Comum*, (Common Curricular National Base), that is, they can be explored during class time and/or in extra-curricular activity curriculum [11]. Environmental education, through sciences, acts as a disseminator of sustainable development knowledge, preparing future citizens with an awareness of social and economic growth concomitantly with preservation of nature [12,13]. To that end, practices that help consolidate sustainable development are evaluated in order to make theoretical concepts palpable to all, especially to children [14]. These practices are designed so that children experience

sustainable development, acquiring experimental and theoretical awareness.

This work aims to explain how agriculture and preservation can coexist in tune, so that cultivation helps in the dissemination of development through environmental education. Hence, examples from *Projeto Jardim de Pneus,* at UMEF Gil Bernades School, will be given, in which the process of learning about environmental education was involved with social aspects in favor of environmental awareness while still covering economic characteristics.

Development

Preservation and Agriculture

These two topics on the present study presents themselves apparently as contradictory, however an explanation about them is necessary so one can reflected on the matters at hand. Throughout our history, agricultural activities have been a source of habitat loss, forest fragmentation and extinction of fauna and flora species [15,16]. However, losses caused by farming practices can also be harmful to humans, as for example, structural changes in biotic and abiotic aspects of soil caused by inadequate handling [17,18]. A healthy soil becomes profitable and employs a group of people who depend on it to survive [19]. Thus, we can state that the preservation factor exceeds a question of environmental awareness, promoting it to be a socioeconomic issue.

Soil is a potential ecosystem with an active role in the formation of habitats [20]. Therefore, through the preservation of solo we promote benefits for capitalist society as well as for nature [21,22]. However, little is disseminated about preservation practices that can be covered by agronomy, which could become a subject of environmental education and sustainability.

Sustainable Cultivation Practices: As a way of joining the sustainable movement, researchers, agronomists and engineers created ways to expand vertical farming [23,24]. Thus, it is no longer necessary to ply through a horizontal territorial space, since this territorial expansion ends up consuming many untouched forests [25]. That is how cultivation practices, such as hydroponics and family farming were devised.

Hydroponics, Family Farming and Agrobusiness: When one works with hydroponics, a physical space is made so it can contain a water tank and several channels that irrigate pots with plants, soil, stone and sand to filter the water nutrients that will be used in irrigation of the plant or it can be recycled and be given a new destination [26]. In the matter of family farming, the government subsidizes small agriculturists to maintain forest areas that surround them and invest on smaller crops, with higher diversity and organics, that is, without using pesticides [27,28].

Lastly, the highest-ranking farmers, are also encouraged to follow a more sustainable agriculture approach, with organic crops and a higher diversity of crops [29,30], using methods such as crop turnover and intercropping.

Crop Turnover and Land Strips: Those who employ the crop turnover method use only part of the land while the other part is restored. Thus, nutrients are not depleted so quickly, allowing the farmer to make use of the land for longer, without handling pesticides or without having to ply through new areas [31-33]. On the other hand, when cultivations are intercropped, what happens is that green corridors are maintained to contribute with environmental health, without the need to use fertilizers or pesticides [34,35]. Once these corridors are maintained, animals that could interfere with the harvest are more restricted to the green corridor and their low transition to the cultivation zone is very beneficial to maintain soil fertility and plant health [36,37].

"Green" Pesticides: Current pesticide and fertilizer products are dealt with greater quality control protocols from the perspective of agriculture sustainable development [38]. In such a way that they only use the bear minimal components, which should avoid eutrophication of the environment by compound saturation [21]. Current fertilizer and pesticide compositions should preferably be made of natural and biodegradable components [39].

Environmental Education, Agriculture and Social Development

Misinformation from society is the main problem that preservation faces when trying to work together with agronomic sustainable development [40,41]. As a way to remedy this problem, the curriculum today addresses issues such as environmental impacts, teaching about it and how to avoid it, albeit superficially and, sometimes, contradictory. Thus, preservation and sustainability are taught in a theoretical way, without practical visibility, in an inconsistent manner [14]. As the environment is an issue to be addressed with greater emphasis, the Brazilian government classified it as a cross-cutting issue [42]. Within education, cross-cutting issues are known as necessary knowledge complemented with extra-curricular activities, according to the *Base Nacional Curricular Comum* (BNCC) [10]. Environment, society and economics, the governing triad of sustainability, are within the cross-cutting issues addressed by BNCC [11,12]. Hence, we present our case study: a proposal based on the dynamics of organic garden communities, and ecological villages. We demonstrate how agriculture and the environment may be reconciled in a way that promotes social economic development, as corroborated by Eno, et al. [43].

Case Study: Initiative of a Cultivation Project at Umef Gil Bernades, Vila Velha, Es.

At UMEF Gil Bernades municipal school, located in the city of Vila Velha, in the state of Espírito Santo, Southwest Brazil, a project was carried out during mid-2013 to 2015. Its initial goal was to create a community garden, and to do so they got a hold of old tires to serve as containers for the soil and fertilizer, and where they would grow vegetables. The project had the active participation of the students who placed the land and fertilizer, planted seeds and seedlings, adorning and changing the school facade.

Community Garden Project Becomes Tire Garden Project

The project that was supposed to be implemented was called *Projeto Horta Comunitária* (Community Garden Project), but it turned into *Projeto Jardim de Pneus* (Tire Garden Project), due to factors of cultivation methods and materials made available for the cultivation process. The initial aim was to educate children about sustainable agriculture, exemplify its management and to show them the results of this type of management. However, theoretical concepts were not worked out in advance in the classroom, and there was a lack of organization about how and whom would take care of the garden so it could prevail. Furthermore, as the vegetable garden was a proposal that came from the community, it would be ideal not only to include students, but all those who would benefit from it. Therefore, teachers, students and the local community should actively participate from the creation of the proposal to the care of the garden.
Hence, in order to follow up on the proposal for environmental education based on sustainable agriculture, the school redid the project so that the practical part was restricted to the students, but they would count on the help of the community.

Tire Gardens

The tire gardens were made by all students who signed up for the "Environmental Workshop", which was financed by the *Mais Educação* government project, with the purpose of current extra-curricular activities that collaborate with the consolidation of the individual as a citizen. With this funding, materials were obtained, such as old tires, spray paints, brushes, protective masks, seedlings, soil and fertilizer. Later on, pet bottles were used to create a vertical hanging garden.

During the making of the garden, children painted the tires, learned about the texture of the soil, typology and organic matter as well as fertilizer management and its active ingredients. After the soil was prepared and the tires were laid, the children planted seedlings and watered them. The tire garden maintenance process was done in partnership with the community and school staff. Initially, the garden was supposed to be at school, on the side of the street due to the lack of internal space. Subsequently, residents that lived close to the school offered the space of their homes supporting the idea of the tire garden.

Pros and Cons of the Project

The projects (tire gardens and community garden) have an interesting proposal that mixes agricultural cultivation process, sustainability, which encourages society to use smaller spaces and urban areas for cultivation, and it raises awareness of solidarity actions that value the practice of environmental preservation.

However, the theoretical part and learning process must precede the practical part of the project, as well as the organization of what will be done and how much will be spent on the project. In addition, the professional who will be directing and monitoring the project should keep in mind what will be addressed in each practical class, that is, what the lesson plan will be.

The theoretical knowledge was not passed on to the students as it should had been, undermining the whole goal of the practical classes, which was to exemplify applicable concepts. Inconsistency of management and cultivation methods (by seedling or seed) were alternated throughout the project due to lack of a fixed organization, which turned study subjects, such as soil, organic matter and plant physiology, superficial.

And, lastly, the most critical point was that the project ended due to the lack of care for the garden, having an opposite effect of what was proposed. The tires, which were reused in order to promote and play the part of sustainability in the project, collaborating to the creation of urban and vegetable gardens, and contributing to issues of preservation, environmental health and capitalization, became untreated waste once again. Visual pollution was evident from plants that started to behave like weeds, out growing their intended space and damaging sidewalks and road. Other plant species died, and the tires became a receptacle for disease vectors.

But one can learn from this project, for example, theoretical knowledge is crucial in the cultivation process, especially in urban areas. Both in the field and in the city, if environmental management and methods of cultivation are not thoroughly studied, the consequences may reach wide negative proportions. Knowing what needs to be done to remedy is not enough for a successful recovery of landscape, some damages may be irreversible or too costly.

Conclusion

In this study we conclude that agriculture works as a disseminator, practical of sustainability and that it can be used in environmental education. In addition, with the green revolution that promoted the proposal for sustainable development, we were able to observe that the agronomic sector adapted itself by creating multiple strategies. These strategies created by agronomy are accessible and can be reproduced in urban areas and small places such as the classroom. In addition, we were able to observe the importance of organizing a cultivation project at school and how it can benefit the community since everyone is educated on the subject.

Final Considerations

Some subjects were not well covered throughout the topics due to the deadline. The subjects of each topic would be too long and there would be not enough time to translate the texts. However, for a future study, it would be interesting to address recycling and reuse of waste for the creation of community gardens and vegetable gardens. In addition, more accurate survey data on how much waste was discarded, how much of it would be used for environmental education process and what would be the government capital profit due to the savings that this would cause in its multivariable systems would enable dissemination, not only of the idea, but also of its practice in a more thoroughly and concrete way.

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