



Cultural Control: A Sustainable Method of Pest and Disease Control

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Agriculture is composed of many factors that alter its production, are of an environmental and management nature, and in terms of management, pests and diseases are of great importance, as they cause a lot of damage to the crop, at different times, and the control of these is essential. pests and diseases to ensure that the plant can reach its production potential. With the concern for a more sustainable production, agriculture has diversified through transformations in the technological and information scopes, which helped to increase the production of production systems. However, only biological and plant-based controls did not guarantee such a large control of pests and diseases, and to complement the control, and to reduce the use of chemicals in agriculture, cultural control was used. This cultural control, together with its sustainable management of pests and diseases, using biological control methods and the base of plant origin, brought new forms of pest and disease control, helping in management, and providing a more sustainable production environment. In addition to these benefits, cultural control is of great importance in the control of pests and diseases, as its control comes as a preventive practice, providing a diversity of the system, and a better control of pests and diseases by breaking cycles, culture, pests and diseases.

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1. INTRODUCTION

Agriculture went through a great development, many processes during this development were aimed at increasing its productivity, while others turned more to the search for sustainable means of production. However, both aimed to adjust the influence of production factors, seeking to express the maximum physiological potential of the plants, ensuring greater results in production and thus increasing yields.

The need to intensify the increase in production is due to the constant growth of the world population, which according to FAO [1] in 2050 the population will be 9.8 billion, 29% more than the current number, and to meet the food demand of the whole. this population, it is estimated that food production will have to increase its production by 70%.

To ensure that agricultural productivity reaches higher values, it is necessary to pay attention to environmental factors and crop management, using techniques and practices, which will contribute to plant production in the crop cycle, contributing during its cultivation and in the different plant organs, increasing final productivity [2, 3].

According to Bernardo et al. [4] and Santos et al. [5], in the part of crop management, sustainable agricultural production and solutions to combat diseases, pests and weeds that affect crops, cause damage and reduce crop production should be sought.

For sustainable production, production systems have adopted the guidelines of sustainable rural development, which is a production process involving the social, economic and environmental sectors, with a focus on economic development, social change in the rural community and the sustainability of the environment environment [6, 7].

According to Padilha et al. [8] and Folmer et al. [9], sustainable rural development is characterized by the ability of the agroecosystem to maintain its income over time, maintaining the productive capacity of the agroecosystem, the preservation of fauna and flora diversity and the capacity of the agroecosystem to sustain itself.

Thus, following sustainable agricultural production, with the guidelines of sustainable rural development, with the objective of increasing production, cultural control was adopted as a sustainable means of production in terms of pest and disease management.

This pest and disease control must be carried out due to the increase in their presence in crops, due to soils, varieties with higher production and less resistant, imported pests and diseases, insects and pathogens resistant to agrochemicals, and the natural enemies that were killed [10, 11, 12, 13].

In addition, pest insects and diseases can cause significant yield losses for various crops, and in extreme cases, the total loss of the crop, thus, knowledge of the pest and disease, and especially the means of control, becomes necessary, to obtain an adequate management of pests and diseases [10, 14, 12,13].

To obtain this proper management of pests and diseases, cultural control comes as a sustainable means of production, bringing many benefits to production systems, which will affect the productivity of a crop, so that its use in agriculture is essential.

2. LITERATURE REVIEW

2.1 Cultural Control

According to Artuzo et al. [15], the production of the culture is altered by several factors, of environmental and local aspects and by the basic techniques used in the culture during its development, being completely affected by the conditions of environment and management.

Management includes: no-tillage, biotechnology, pest and disease control, optimization of agricultural inputs and precision technologies, in addition to moisture management, total porosity, soil density, fertilization, cultivation system, spacing, interaction between plant and microorganism, among others [15, 16, 17, 18].

In order to increase production, it is necessary to properly use agricultural practices, ensuring better productivity and the sustainability of the production system, and a way to ensure that this occurs is the adoption of a sustainable practice, and one of them is cultural control [19, 20, 21].

Cultural control consists of the use of good agricultural practices, manipulating the pre-planting and plant development conditions, aiming to favor the growth and development of the crop, in relation to the pathogen, agricultural pest and the weed [22, 23, 14].

However, in addition to what was presented, cultural control offers benefits to all production sectors, and helps to control not only pests and diseases, but also weeds, which also affect crops, based on practices that favor the culture.

Good agricultural practices for pest, disease and weed control stand out, such as: crop rotation, plowing, fertilization, scavenging of infested plant parts, harrowing, bait plants, weeding, destruction of crop residues, well-managed irrigation, pruning, spacing between rows, planting density, proper planting time, use of varieties adapted to the regions, use of mulch, among others [22, 14].

Each agricultural practice will present benefits to the crop, depending on the practice adopted, and will have different effects on each production system, it is important to choose the best management for each crop, and the agricultural practice that fits the proper control, and the target to be controlled.

Thus, the importance of management in the production system is noted, whether for weeds, pests and diseases, and the phytotechnical issues of each crop, thus demonstrating the huge set of factors that affect productivity, thus, control cultural is essential for the productivity of the crop and for the system of sustainable management of pests and diseases.

2.2 Sustainable Pest Management

In agriculture, pest control is essential to ensure that the crop develops, as several pests affect crops, and some of them cause significant losses, even total loss, and to reduce damage to plants the use of sustainable management of pests provides better pest control, associated with other control methods, expanding the diversity of products and modes of control, enabling sustainability in the production system.

In general, according to Zanuancio Júnior [24], alternative management or sustainable management observes natural cycles in order to respect the interrelationships and proportions of

the environment, working with systems, in an interdependent system.

Two control methods in sustainable pest management are important, such as biological and plant-derived control, which are biological insecticides and based on plant extracts, and are defined as alternative means of pest control, and with very good control results, with effects similar to those of chemical products [25,26].

According to Ferreira et al. [27] and Zanuancio Junior et al. [24] biological control is a control method that uses natural enemies of pests, with the action of parasitoids, predators and pathogens in maintaining the density of another organism at a lower level than would normally occur in the system.

Plant-derived products are controlled by the use of products based on plant-derived plant extracts, which are organic insecticides, which present toxicological effects for a certain range of insects [28,29, 30].

The management of pests with biological insecticides and based on plant extracts in agriculture is very important for the next crops, due to the various benefits provided, maintaining the sustainability of the production system used, in relation to the conservation of natural resources and the increase in biodiversity in the various production systems [24, 31].

According to Ferreira et al. [27] and Lins Junior [32] these sustainable insecticides also have other benefits such as: selectivity, low cost, ease of adaptation, easy degradation in the environment, prevention of pest resistance, decrease the rate of poisoning of workers, farmers, and consumers, and preserve society as a whole for future generations.

Thus, the implementation of these control methods as sustainable management, linked to cultural control, helps in greater pest control, since pest control based on biological or plant extracts is usually carried out in the presence of pests, and cultural control is already it is a preventive method, which often, as described, can prevent the presence of pests in the crop.

2.3 Sustainable Disease Management

Disease control is essential to ensure the production of a crop, as several diseases affect crops, and cause minor plant damage, and in

extreme cases even crop loss, and the use of sustainable disease management helps in disease control, increasing the possibility of effective disease control in a sustainable way.

Thus, it is necessary to use alternative methods to control phytopathogens, one of these methods is biological control, which can be carried out with the use of microbial agents and plant extracts that have antagonistic effects in the control of pathogens [33,34, 35].

These microbial agents and plant extracts are biological control methods, with lower cost, ease of application, transformation or recovery of contaminated soils, and do not leave residues in the environment, providing sustainable management [36, 37, 38].

The action mechanisms of biological control act in antagonistic relationships between the control agent and the phytopathogens, such as competition, predation, mutualism, parasitism and resistance induction in the host plant [33, 34, 35].

In agriculture, some options stand out, such as: cow's urine, milk and whey, coconut soap, sulfocalcium and Bordeaux mixture, and plant extracts based on cloves and cinnamon [39,40].

The use of these biological fungicides and based on plant extracts are important in agriculture, and together with cultural control, it provides greater disease control, due to the various benefits provided, favoring the development of the culture, maintaining the sustainability of the production system and ensuring productivity through disease control [36, 37, 38].

2.4 Cultural Control In Pest And Disease Control

With its use, cultural control brings many benefits to production systems, in addition to preserving the system, it guarantees sustainability and sustainable production.

However, the benefits presented include the control of pests and diseases with crop rotation, which occurs due to the breaking of crop cycles, providing for the diversification of the environment, reducing the selection of species and reducing the occurrence of the most problematic ones, or more difficult to control, demonstrating cultural control as a sustainable management strategy [41,42, 14].

To ensure a better control of pests and diseases in a sustainable way, the use of cultural control comes as an alternative control, and together with biological control and based on plant extracts, it ensures a more sustainable pest and disease management.

In addition, these sustainable control methods gained much prominence due to the problems of uncontrolled use of chemicals in agriculture, which was generating resistance to pests and diseases, resurgence and outbreak of pests and diseases, thus, cultural control was a good alternative in the management of pests and diseases [26, 28].

Of the various cultural control practices, crop rotation is one of the most important, in terms of soil conservation, crop development, and other aspects as well, but the set of cultural control practices is essential for better management of pests and diseases.

In this way, cultural control and biological and plant extract-based controls can together make better control of pests and diseases, enabling better crop development, and thus, greater chances of increasing your crop productivity in a better way sustainable.

3. FINAL CONSIDERATIONS

Crop management is essential to ensure that a crop develops and has a production, therefore, pest and disease control is essential to protect and prevent damage to the crop, providing better conditions for the plant to express its productive potential.

Cultural control is intended to help in the management of pests and diseases, because with its practices, it guarantees a more favorable environment for the plant, in addition to providing unfavorable environments for pests and pathogens, and thus, controlling pests and diseases, making it possible to increase the productivity of the crop.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of

knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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