

The influence of the agricultural management systems in the maintenance of the biodiversity in benefit of the Phyto sanity control

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Abstract— *The management system adopted in the agricultural production influences directly on the biodiversity of the growing areas, whether inhibiting or favoring the proliferation of the natural biota. This article aims to highlight the influence of agronomic practices in certain cropping systems that interfere in the control of the Phyto sanity by the participation of the biodiversity. The greater part of the agricultural Production in the world comes from the conventional growing system, which gained strength from the ‘Green Revolution’ in mid-twentieth century, but due to its production techniques that contribute negatively for the environmental devastation, mainly by the monoculture, use of non-renewable inputs, agrochemicals, and others, not respecting the environment, alternative forms of Productions based on organic or agroecological management emerged with the adoption of practices which use renewable inputs, polyculture, green fertilization, organic fertilization, nutrient cycling, banning of agrochemicals, and mainly respecting social requirements, cultural and environmental. Thus, the alternative management tends to provide the development of the agrobiodiversity, essential for the adoption of practices related to the biological control, with no use of pesticides, enabling a food production with quality, with no chemical residue and ecologically correct, meeting the world requirements of the world market. Therefore, researches are needed, having a greater interaction between the researches, extension works, growers and society, All in the search of the environmental sustainability in the agricultural production.*

I. INTRODUCTION

The adoption of the type of the agricultural systems of paramount importance when it comes to biological pest control and diseases in agricultural cultivations. In the conventional cultivations implemented from the 2^o world

war with the advent of the “Green Revolution”, who preached to feed the world population through the modernization of the agriculture with the adoption of practices based on the monoculture, overlapping cultural cycles, intensive mechanization, technified irrigations,

massive use of pesticides, contributed to the environmental degradation and the increase of production costs. Besides favoring the development of phytopathogens to the crop, once these practices, by not contemplating the biodiversity in these areas contribute negatively for the establishment and maintenance of the natural enemies of pests and diseases (VENZON et al., 2019).

The conventional agricultural production, due to the considerable environmental damages began to lose support from part of the world population worldwide, that requires alternative production models based in organic systems and / or agroecologicals to reduce or chemical residues in the final product to be consumed.

The agricultural growers, due to the requirements of the consumer market, became more concerned with problems related to the poor preservation of the environment caused by the conventional production practices and started the adoption sustainable alternative technologies, practiced since the ancient times with organic practices which promote the agrobiodiversity, such as the polycultures, crop consortium, crop rotation, agroforestry systems, organic fertilization and other processes that favor the natural and biological interaction, mainly those related to biological control.

As one of the greatest demands of chemical products in the agricultural production is related to the management of the phytosanitary, the natural biological control stands out, this, being favored by the interaction of plants in the growing areas, and being possible to cause repellent effects and not food preference, being it visual or olfactory to the phytopathogens (Togni et al., 2010), Besides of attracting and favoring the maintenance of species of natural enemies which act on the pests (VENZON et al., 2015; TOGNI et al., 2018).

In addition to the regulation of the phytosanitary, the biodiversity in the agricultural cultivations also provides several other ecosystems services important in the productive process, like the pollination, the nutrient cycling, the microclimatic regulation and the increase of the soil fertility (SUJII et al., 2010). These biological processes and their persistence depend on the maintenance of the biodiversity in the crops, aiming the functionality and the permanence of the associated ecosystems services (VENZON et al., 2019).

Thereby, the present work aims to contribute with relative information's regarding to the agronomic management practices essentials to the agricultural production and which interfere on the development and maintenance of the natural biodiversity, and which may favor the biological control of pests and diseases, reducing

then the pesticides used in the conventional systems of production.

II. METHOD

The present work is about an exploratory and qualitative bibliographic research with consultations of scientific publications of access to bases like: IEEE, Science Direct, Scielo, and others, such as books, dissertations, these and journals, aiming to summarize and highlight the importance of alternative practices based on strategies management of the agrobiodiversity in agricultural systems for the biological control of pests and diseases.

For Gil (2017), the exploratory researches seek to list hypotheses about the theme or a studied phenomenon for other researches test and validate them, being more flexible in their planning process, because they intend to observe and understand the most varied aspects related to the studied phenomenon, being one of the principles of the bibliographic survey, to have a better comprehension of the problematic in study.

This way, this article shows the importance of the biological poise in the cultivations, provided by agronomic practices which favor the biodiversity, Essentials to the environmental sustainability in the diverse agrosystems, minimizing the noxious effects of the phytosanitary in the agricultural production.

III. DISCUSSION AND RESULTS

3.1 Management of the biodiversity in the control of the phytosanitary in agrosystems.

The exploitation of the land for the agricultural production is essential for the human survival, but, being it Direct or indirectly the actions of the productive management interfere in a significant way in the biodiversity of the cultivated areas, and depending on the type adopted may cause serious damages to the environment and the health of the workers and consumers of agricultural foods, Besides to anticipate de degradation of the environment, turning the areas unable for the agricultural production (ALTIERI, 2012).

In the seek of minimizing the environmental effects in the productive agrosystems, many studies are being implemented to introduce and agricultural management turned to the fortification of the agrobiodiversity and the environmental sustainability, putting itself in debate the type of management system, being it the conventional or the alternatives, most adequated to be kept the high

productivity of food with minimal negative impacts to the environment.

3.1.1 Organic practices which favor the biodiversity

The structural complexity of the agricultural landscapes influences the local biodiversity, as well as the services of the associated agrosystems (HAENKE et al., 2009). The diversity of the vegetation favors the increase of natural enemies of pest insects, having in view of it provides alternative food resources, such as the pollen and the nectar, for adults of parasitoids or predators, increasing their longevity and reproductive becoming more effective in diversified systems than when in agricultural monocultures (BEGUM et al., 2006).

The alternative systems of agricultural production tend to adopt diverse practices associated to the productive management which favor the agrobiodiversity, defined as the plot of the biodiversity constituted by a set of organisms and ecosystems that present Strong relations to the human beings (Jackson et al., 2007), being possible to be domesticated, semi domesticated, cultivated or managed by the man, which represents a practically inexhaustible range of combinations between their four levels of complexity: diversity within the species, between the species, between ecosystems and ethnocultural diversity, essentials for the development of a sustainable environment (STELLA et al., 2006).

Depending on the sort of the agriculture, the area to be explored, the technical knowledge and available resources, various organic technologies may contribute in a significant way in benefit of the biodiversity when applied in its proper way.

Because, it is not only to apply organic practices in the agricultural cultivations, but to combine a determined alternative management that can be better adequated to the expected purpose, within technical knowledge that favor the biological interactions together with the exploited cultivation.

Among the various alternative technologies we can highlight the following:

- **Agroforestry systems (AS's)**

The policultures which combine agricultural crops and tree species are named AS's. In the AS's, the incidence and the damages caused by the pests are reduced, mainly by increasing the population of natural enemies and increasing the difficulty of finding the crops by the pests, through the moderation of the microclimate and through

the increase of water and nutrients in the soil (PUMARIÑO et al., 2015).

Generally, the trees that compose one AS are selected by criteria based on the compatibility between the crops, in the biomass production, in the easiness of management and in the diversification of the production with species of the native flora of the region (SOUZA, 2010). In addition to the introduction of plants which favor the biological control of pests (VENZON et al., 2019).

The AS's can be interspersed with vegetable planting plots in a way that these planting plots stay divided by lines of AS's. In the off-season ages of the vegetables the natural enemies tend to migrate from the planting area as to the agroforestry's, where keep their population reduced. By the occasion of a new planting, the natural enemies tend to recolonize the new cultivated areas and increase their populations (HARTERREITEN-SOUZA et al., 2014).

The AS's, when applied properly are considered those that present the higher rates of sustainability in the agricultural cultivations.

- **Polyculture**

The simultaneous crops of different taxonomic groups create a heterogeneous environment, often forming mosaics of vegetation which difficult the localization of the host plant by the herbivore, and interfere negatively in the establishment of the pest populations (ROOT, 1973).

The areas, in general, are smaller, when compared to the monoculture, and present major number of species and biological interactions favoring the natural biological control. Among the strategies used in the crops in polycultures is highlighted the use trap crops. For that, it is necessary to determinate at first which is the main culture and the key pests associated and after that, it is planted next to the other culture with major preference for the insect and minor interest for the grower in a given moment (SUJII et al., 2010).

As already commented, the technical agronomic planning is Paramount for the success of the alternative strategy applied.

- **Consortium of cultures**

The association of cultures in which two or more species with different cycles and vegetative architectures grow simultaneously, exploited concomitantly in the same area and in the same period of time, not necessarily been sown at the same time present various positive aspects, mainly when talking about maintenance of the biodiversity

in cultivated areas. It can be done in the form of strip crops, mixed crops, mosaic plots, cultivars in alternated lines and ground cover crops. The arrangement in the time can be established as simultaneous cultivation, in sequence, with synchronous or asynchronous combinations, and continuous or discontinuous (SUJII et al., 2010).

The mechanisms involved in the pest control through the diversification by the consortium of cultures are due to the Direct or indirect actions on the pests. In the Direct action, one of the associated cultures imposes physical barriers and / or chemicals which difficult the localization, the reproduction and / or the colonization of the host culture by the pests. Whether by the chemical repellency, masking and / or inhibiting the feeding, due to volatiles from non-host plants, movement prevention, pests immigration or sync optimization between the pest cycles and their respective natural enemies (NICHOLLS et al., 1999).

In the indirect action, one of the associated cultures allows the increasement of the abundance and / or diversity of natural enemies of the pests by providing vital resources for the survival and reproduction of the pests. Nonetheless, the consortiation of cultures must be studied before its implementation, because effects completely contraries to the expected may occur, Besides to repelling the pest insects, can attract them as well, compromising the cultivation base (PICANÇO et al., 1996).

- **Management of Covered Crops**

The green fertilizes, so used in agroecological cultivations for the improvement of the chemical characteristics, physical and biological of the soil, can also contribute to the reduction of the incidence of pests (VENZON et al., 2006).

It is considered as a special type of consortium. Between its advantages are the protection of the soil against the impact of rains (and consequent erosion), increasement of the infiltration capacity and water retention, in addition to the maintenance of the porosity na the aeration, attenuating the temperature and humidity oscillations, intensifying the biological activity in the growing area (HARTWIG; AMMON, 2002).

The living coverage also can provide the increasement of the organic matter content, the availability of macro, and micronutrients, pH stability and reduce the toxic effects of the aluminium and the manganese. Living coverage of the soil also help bringing to the surface from the deeper layers, improving their natural properties. Besides that, can present allelopathic effects, liberating

substances from the roots that inhibit the germination of weeds, which contributed to diminute the necessity of weedings, and yet, to contribute for the biological control of pests. Some plants make the microclimatic conditions more adequated for the development of predators and parasitoids, favoring the increasement of the population of natural enemies, particularly predator insects with earthly habits, it may also dilute the effects of the infestation (SUJII et al., 2010).

- **Genetic Variability**

The use of varieties and / or genetically resistant pest cultivars available in the market, as well as the use of species and plant varieties adapted to the local environment conditions and to the management adopted, mainly the organic, ar the best preventive measures of pest control to be used. In California, for example, Letourneau and Goldstein (2001) observed that in organic tomato cultivars occurred a major density of natural enemies and minor density and damages from phytophagous insects in relations to the conventional cultivate. Resistant or tolerant varieties arranged between the susceptible may contain the dissemination of the insects, protecting the susceptibles (SUJII et al., 2010).

- **Crop Rotations**

The alternance of cultivated species in a same area is a traditional practice and widely recommended due to the nutritional question of the plants and phytossanity. Nonetheless, its application is more efficient for pests specialized fews of host species, being more used for the control of diseases caused by soil fungi, involving the deceleration mechanism of the pathogen by the stimulation of the antagonists. The use of plants from unrelated families is important because it allows the breaking of the biological cycle of the pests and pathogens, preventing them from spreading from the oldest to the newsts crops (SUJII et al., 2010).

- **Management of invasive plants**

Practices as weeding or selective thinning of invasive plants and even the cultural management of the area are important practices for the management of pests, in the average of these plants serve as refuges and factor of attraction of natural enemies.

These plants may offer feeding resources, as alternative prey, besides the nectar and the pollen that serve as exclusive diet for adults and parasitoids or complementary diet for predators. In addition to this, these plants serve as

local refuge for mating and oviposition for many species of natural enemies of pests, increasing the chances of establishment of these populations in cultivated areas. Other factor to be considered is that some determined species can also increase the structural complexity of the agroecosystem and difficult the meeting of the host plant by the phytophagous insect (MEDEIROS et al., 2009).

- **Other Organic Practices**

In addition to the organic practices associated to the cultures cultivated with the intention of improving the biodiversity and to reduce the entrance of external inputs, other management activities can be adopted which present similar biological results, such as:

- ✓ **Marginal Vegetation Strips**

The range established between the limit of the cultivated field and the planted area with the agricultural crops, Generally form transition areas (ecotones) with huge diversity of species and are used rather by predator insects, and possible composed by native species of natural occurring or implanted. The strip of the marginal vegetation can be composed by trees, shrubs, flowering herbaceous plants, including the ornamentals, grass, and others (RIES; FAGAN, 2003). Anyway, it is a practice that helps in good ways in the maintenance of the biodiversity of the cultivated area.

- ✓ **Vegetation Corridors (or biological corridor)**

Are strips of vegetation that surround the property, allowing isolation of the conventional growing areas from the other neighbor areas. They can also be used for the Division of the cultivation plots and present multiplex purposes and work as phytosanitary barriers, difficulting the free circulation of pests and diseases the neighbor properties and between the cultivation plots, and still favoring the creation of microclimates more adequated to the cultivate, mainly to the vegetables, and the formation of areas of refuge.

These strips work like some “avenues” that facilitate the movement of benefic arthropods, Among which parasitoids and pest predators. Besides that, provide the increasement the interface between the area with the native vegetation (such as forestries, forest fragments and riparian forests), that serve as a reservatory of natural enemies (VENZON et al., 2019).

- ✓ **Crop Borders**

Border strips with cultivated species, Generally are with the type “corridor” (linears) or “island”, that border the outermost rows of the area (s) with the agricultural crop (s) and also serve as barrers and wind break. Generally, the natural biological controls more intense in the neighbor planting lines to the native vegetation or living fences, occurring the opposite in the central lines. This type of adjacent vegetation in the borders of the growing area is commonly used as living fences and windbreaks, constituted with a single of a few species (SUJII et al., 2010).

- ✓ **Planting Season**

The determination of the planting season is important, because of the ideal is to plant when its phase of greatest susceptibility scapes from the attack of pests.

The anticipation of the planting processor the use of earlier varieties are practices that collaborate for a minor attact from the pests, due to na asynchrony in the relation plant-pets. Planting in non favorable times to the plant development increases the predisposition to pest attack, although artifices can be used to conter this situation, like the use of the irrigation or the cultivate in a vegetation house. It is worth to say that favorable conditions to the plant development can also favor the pest development. In these cases, only the use of control measures, like biological control agents, can minimize the caused damages (VENZON et al., 2015).

- ✓ **Organic Fertilization**

Refers to the use of various types of residue (waste), like tanned manure, worm compost, fermented compounds, enriched biofertilizers with micronutrients and mulch, between others. All these materials are rich in useful organisms, macro and micronutrients, natural antibiotics and growing substances. The organic fertilizer, by improving the physical properties, chemistries and biologies of the soil, allows a good development of the culture and giving them resistance to pests (MEDEIROS et al., 2009).

- ✓ **Water management in the cultures**

The irrigation is one of the cultural practices with major impact in the occurrence of determined insects. Has special importance to the cultivate of vegetables, that normally request high volumes of water during the cycle of production. The frequency between the waterings, water depth applied and form of irrigation (sprinkling, dripping

or infiltration for example) interfere substantially in the removal of young forms (eggs, nymph or larvae) and, eventually, affect adult insects present in the surface of the plant (TOGNI et al., 2010).

IV. FINAL CONSIDERATIONS

The many alternative methodologies employed in the agriculture seeking to produce food without chemical residue and that at the same time assuage the effects of the agricultural activities to the environment present a growing demand in all the world, required mainly by the consumer market, favoring the increase of organic crops and / or agroecologicals.

Within the premises of the environmental preservation is the ecological control of pests and diseases. The control of pests and diseases in the conventional production system requires a high demand of agrochemicals, but the alternative management of pesticides are replaced by practices that favor the biodiversity, highlighting the biological control due to the perfect interaction between the biota in the production areas, and tend to reduce or banish the economic damages caused by the phytopathogens.

Even so despite the advances of biodiverse practices in the controls of pests and disease, but the difficulties of production are still recurrent, needing researches that aim to improve the biological management of the phytosanitary to meet the prerogatives of the sustainable development in the agricultural production.

Therefore, for there to be an increase and a better use of these ecological strategies there must be a major interaction between the researches, extension workers, growers and the society, so that in sync increases the understanding about the importance of the biodiversity in the agricultural systems and make part of the construction of one sustainable agriculture in long term.

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