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AGRICULTURAL SOILS EVALUATION, AFTER USE OF DIATOMITE AS AN ECOLOGICAL INSECTICIDE

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Abstract: Soil quality is best defined in relation to the functions that soils perform in natural systems and agroecosystems. The quality of soil resources has historically been closely related to soil productivity. Indeed, in many cases the terms soil quality and soil productivity have been nearly synonymous. Soils have important direct and indirect impacts on agricultural productivity, water quality and the global climate. Soils make plant growth possible by mediating biological, chemical and physical processes that provides plants with nutrients, water and other elements. Limited availability and quality of water resources are important aspects of natural resource management, and the protection and conservation of water resources is a key requirement in the principles of sustainable development. Climate change is just one of the responsible factors for the emergence and spread of diseases and pests in vegetable crops. Plant pests continue to be one of the biggest constraints on food and agricultural production. In order to protect the soil, and implicitly the environment, it is necessary to choose ecological methods to combat them. Thus, a model of eco-sustainable technology for reducing and preventing diseases and pests was developed, in which diatomite was selected as an ecological insecticide. The main chemical indicators were analyzed, both in the year of application and in the next year, in order to establish the long-term effect.
Keywords: Climate change, diatomite, ecological, agriculture

INTRODUCTION

The soil is an essential resource for all cultivated plants, being not only a support for plant roots, but also a reservoir of essential nutrients needed for plant growth. Because the soil is a complex system that interacts with other systems, participates in phytomass production, influences the ecosystems production capacity, having an essential contribution to recirculation of chemical elements in nature and regulates the atmosphere and hydrosphere composition. The soil is a living and quality system and must be preserved accordingly. This is the result of several interactions between biological components, including microbial communities that are essential for physico-chemical functioning. It is composed of mineral particles, organic matter, water, air and living organisms, in fact it is an extremely complex, variable, and living environment (EC, 2020 (a)).

Soil not only makes life on Earth possible, but also helps fight climate change. About 70 billion tonnes of organic carbon - almost 50 times more than the EU's annual emissions - are kept safe under our feet. Soil is the second largest carbon sink on the planet after the oceans and this is another reason why is so important to maintain a healthy soil (EC, 2020(b)).

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The objective of the agricultural production sector, which takes place mainly on the ground, is no longer simply to maximize productivity, but to optimize, in the conditions of a more complex agricultural landscape, a rural development under urban pressure. (Godfray et. Al, 2010). Obtaining a good soils quality condition of soils is a complex process, which depends on several factors (Oara, 2015).

The method of assessing soil quality is based on quantifying certain indicators that refer to stable or intermediate properties, determining the functional capacity of the soil (ICPA).

Soils have important direct and indirect impacts on agricultural productivity, water quality and the global climate. Soils make plant growth possible by mediating biological, chemical and physical processes that provides plants with nutrients, water and other elements (NRC, 1993). Limited availability and quality of water resources are important aspects of natural resource management, and the protection and conservation of water resources is a key requirement in the principles of sustainable development (Tociu et. al, 2020).

Crops are threatened by soil-borne diseases, which makes them difficult to control due to the "hidden" nature of pathogens and the low effectiveness of conventional treatments. In this context, the interest of agricultural practices that use these ecological changes needs to be rethought. These practices significantly affect soil quality, which in turn affects the plants quality (Oara, 2015). According to studies, although there is clear evidence that climate change is altering the distribution of diseases and plant pests and animals, the full effects are difficult to predict and quantify. The changes in temperature, humidity and greenhouse gases can increase the growth and growth rate of fungi and insects, as well as altering the interactions between pests and their hosts. While new pests and diseases have regularly emerged throughout history, climate change is responsible for many diseases and pests. (FAO, 2016). Plant pests, including insects, pathogens, and weeds, continue to be one of the biggest constraints on food and agricultural production.

For example, fruit flies cause extensive damage to fruit and vegetable production, and as global temperatures continue to increase, they are finding more areas to adapt and develop. Control of these pests often requires the use of pesticides, which can have serious side effects on human health and the environment, which is why environmentally friendly methods are recommended. Climate change is only one of several "global change" driving the emergence and spread of plant pests and animal diseases (FAO, 2016).

MATERIALS AND METHODS

During the period of 2019 agricultural year, in the study area at SCDL Buzău, three varieties of vegetables were planted, namely Rubiniu onions, Menuet dwarf garden beans and bell peppers from Buzău 10. They were grown on different surfaces as follows: onion variety on 3000 m^2, peppers on 2000 m2 and beans on 5000 m2. In 2020, the cultures succeeded as follows: on the area cultivated in 2019 with onions, were planted peppers in 2020, on the area cultivated in 2019 with beans, were planted onions in 2020, respectively on the field cultivated in 2019 with peppers were planted beans in 2020.

They are part of the varieties vulnerable to diseases and pests, so for an ecological agriculture and environmental protection it was chosen to develop an experimental model of eco-sustainable technology to prevent and reduce the aggression of diseases and pests in vegetable crops, where as an ecological variant of insecticides was used diatomite (Deák et al., 2018).

Diatomite was applied on the soil in the powder and liquid form, being used the one from Pătârlagele quarry, Buzău County, due to the high insecticidal effect (ICDPP, 2014, Laslo et al., 2019). Each culture was customized according to the amount of diatomaceous earth powder administered (Laslo et al., 2019) -Table 1. The liquid diatomite was administered in an amount of 5l / 7sqm.

Table 1. Content of solid diatomite administered

V1	control sample
V2	52.5 g diatomite /7 sqm (administered grams / repetition)
V3	105 g diatomite /7 sqm (administered grams / repetition)
V4	210 g diatomite /7 sqm (administered grams / repetition)

Soil samples were taken from a depth of 0-30 cm, shortly after application in 2019, and one year after the application of diatomaceous earth in 2020, in order to verify the effect of its long-term application

RESULTS

In order to determine the degree of soil quality impairment, following the application of eco-sustainable technology for the prevention and reduction of diseases and pests, where diatomaceous earth was used as an insecticide, the main chemical indicators of the soil were analyzed.

In order to establish the effect of diatomite was chosen the version (V1), which is the control sample, and where the diatomite was not administered, and the version (V4) where the maximum amount was applied, respectively 210 g /7 sqm. The following table presents the results of the main chemical indicators analyzed (Table 2).

Table 2. Chemical analysis

	2020		2019		Chemical indicators
ONION	V1(R3)	V4(R3)	V1(R4)	V4(R4)	Version
ONION	8,59/24,5	8,55/24,1	7,98	8,00	pH (units pH/°C)
ONION	233	192,8	154	150	Conductivity (μS/cm)
ONION	0,094	0,093	0,100	0,102	Total phosphorus (%)
ONION	0,14	0,14	0,18	0,16	Total nitrogen (%)
ONION	2,37	2,45	2,69	2,57	Humus (%)
ONION	1,38	1,42	1,56	1,49	Organic carbon (%)
PEPPER	V1(R4)	V4(R4)	V1(R4)	V4(R4)	Version
PEPPER	8,52/24,3	8,31/24,1	7,9	7,96	pH (units pH/°C)
PEPPER	223	299	164	183	Conductivity (μS/cm)
PEPPER	0,106	0,102	0,101	0,092	Total phosphorus (%)
PEPPER	0,15	0,15	0,17	0,13	Total nitrogen (%)
PEPPER	2,46	2,51	2,41	2,47	Humus (%)
PEPPER	1,40	1,46	1,40	1,43	Organic carbon (%)
BEANS	V1(R2)	V4(R2)	V1(R4)	V4(R4)	Version
BEANS	8,44/24,4	8,49/24,9	7,99	7,90	pH (units pH/°C)
BEANS	212	227	168	140	Conductivity (μS/cm)
BEANS	0,096	0,094	0,102	0,108	Total phosphorus (%)
BEANS	0,14	0,14	0,17	0,17	Total nitrogen (%)
BEANS	2,25	2,52	2,77	2,97	Humus (%)
BEANS	1,30	1,46	1,61	1,72	Organic carbon (%)

In the case of these three crops, can be observed an increase in the soil reaction value (pH), in both versions from 2020, but it falls into the same category, namely alkaline pH. This cannot be considered to be due to the application of diatomite, as the increase was recorded in both versions.

Analyzing the total nitrogen content, a decrease can be observed, except for the pepper culture, where diatomite was administered, and the phosphorus level increased from a small range (0.10 - 0.14 N%) to a medium one (0.14 - 0.27 N%).

In the case of the onion field, the amount of nitrogen in the soil has decreased from a medium to a small content. The phosphorus content is present in appropriate amount for crops grown in field, the differences between 2019 and 2020, consisted in small decreases, but not significant, to affect soil quality. An imported element can be observed in the case of onion and bean cultivation in 2019, when the amount of phosphorus in the soil was higher on the crop where diatomite was applied, and in 2020 in the same soil the phosphorus content decreased, thus we can conclude that diatomite brings a benefit to the soil, being rich in nutrients and phosphorus.

The proportion of humus in the soil is an average one, with over 2% content. In the case of this indicator, also has been a decrease from one year to another, except for pepper cultivation where there has been a slight increase. In this case, the application of diatomite to the onion and bean crop contributed to the.

In 2020, the results indicated a significant electrical conductivity increase for all three crops, but these values are within the normal values for agricultural soil, the value of salts falling within the "non-salty" category (Malik et al., 2018).

For the 2019 soil samples, physical analyzes were performed, and the density and particle size distribution were determined with standard laboratory tests (Dumitru et. Al, 2019). From a physical point of view, the soil from SCDL Buzau has a medium to sandy texture (Laslo et al., 2019). By analyzing the values of the organic carbon content, it falls into the category of soil with an average carbon content (1.17-2.32%) (Rus, 2013).

Analyzing the eco-sustainable technology for the prevention and reduction of diseases and pests, using diatomite as an ecological insecticide, it was found that it does not affect soil quality, and in some situations contributes to improve it, from a chemical point of view.

CONCLUSIONS

Eco-technology for reducing and preventing diseases and pests in vegetable crops, uses diatomite as an ecological insecticide. Within the scope of this research, has been used diatomite from the Pătârlagele quarry, due to the high insecticidal effect.

The main soil chemical indicators were analyzed (pH, humus, organic carbon, conductivity, total nitrogen, total phosphorus), in order to highlight the effect of applying diatomite on the soil, both shortly after application and for a long period, more precisely about a year. The results of the analyses showed that solid diatomite used in the maximum amount of 210 g / 7 sqm, does not affect soil quality, and in some situations contributes to improve it, from a chemical point of view.

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