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Soil Amendments the Alternative Approach in Modern Agriculture



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Abstract

Agricultural crops attack by several pests one of them is plant parasitic nematodes (PPN). Plant parasitic nematodes or phytonematodes found to be one of the most widespread diseases in the last two decades. PPN causing losses in high value crops worldwide estimated by \$157 billion annually. The synthetic nematicides are an effective solution, but the risk was rising by using these chemicals. Thus, alternative tools were necessary to reduce the impact of chemical nematicides on human health and the environment. Using organic matter from animal or even plant origins has a lot of advantages for humans and the surrounding environment. Soil amended with organic materials improves the microbial balance and increase the soil contain of minerals.

Introduction

Agriculture considered the main source to human beings and animals survival. There are about 925 million humans are suffering from chronic hunger around the world [1]. Based on that, in the next 4 decades the global food production must increase by 70% to feed about 9 billion people worldwide [2].

Agro-crops are attacking by different and many pests around the world such as insects, fungi, bacteria, viruses and nematodes. Plant parasitic nematodes are from the most common pests which causing damages estimated by millions of dollars. Those pests reduce the agro-production which reflects on agricultural industry. According to the economic statistics the plant parasitic nematodes cause considerable economic losses annual by \$125 billion globally [3]. But about \$157 billion is the annual losses of economic crops worldwide were recorded by Abad et al. [4]. While, in the newest statistics the losses was estimated by \$118b annually [5].

Currently, root-knot nematodes (RKN) considered the most famous and prominent genera around the world. In addition to, they are the most common and destructive diseases. RKN infesting different crops, such as vegetables crops, oil crops, fiber crops, and grain crops and fruit trees next to weeds which may play a secondary host. Root-knot nematodes have a wide host range approximately 5500 host species [6]. There are more than 100 species that follow genus *Meloidogyne*, but the

most widespread and well-studied species were *M. arenaria*, *M. incognita* and *M. javanica*.

To stop the nematode diseases' the best solution from the viewpoint of farmers is using of chemical pesticides. Since chemical control of plant parasitic nematode by the involvement of synthetic nematicides one of the most potent and effective method for nematode management. The chemical nematicides including fumigants such as Ethylene Dibromide, 1,2-Dibromo-3-Chloro-propane, Chloropicrin, Metam-sodium, Dazomet, Methyl Bromide and Methyl Iodide. Furthermore, non-fumigants nematicides containing Aldoxycarb, Carbofuran, Oxamyl, Fenamiphos, Cadusafos and Fosthiazate which are the widespread applied methods [7].

The usage of agricultural pesticides rising in last 25 years between 44% and 4800% in all pesticides types around the world [8]. It was found that the intensive use of chemical nematicides cause adverse effects on humans health and surrounding environment. In addition to the high cost, resistance phenomena and elimination of the non-targeted organisms. Thus, all these negative impacts push the scientists to find alternative solutions could be use easily and safely.

Recently, certain alternatives were discovered to manage plant nematodes. Organic amendments, biological control, and heat-based methods are representing a new trend in integrated

nematodes management (INM). Therefore, the aim of this short article is to clarify the importance of soil amendments as tool in pest management.

Soil additions as new tool in plant parasitic nematodes management

In the last few years there has been an increasing interest in using soil amendments and other composted materials as tool of the biological control to suppress plant parasitic nematode [9]. Organic amendments are cover several sources and products, including animal manures (poultry, cattle), green manures from cover crops or crop residues, industrial wastes (oil seed cakes), or town wastes. The application of these materials done in composted or not composted form with the soil [10]. Linford et al. [11] considered the first scientist who described the using of organic amendments to control pests, since then many reviews have focused on the use of organic amendments to control plant-parasitic nematodes [12-14].

There is no doubt that synthetic nematicides are the easier and quick way to control diseases. But there are alternative and new trends could be used to manage PPN. a lot of investigations about utilizing many plant residues, wastes and pre planting soil bio-fumigants as soil treatment for managing plant-parasitic nematodes and other plant pathogens were documented by many authors [2,15,16].

One of the most effective control strategies of plant nematodes is soil bio-fumigation. The bio-fumigation is applies to plants that follow family brassicaceae. Later, the definition expanded to include non-Brassica plant species, several plant and agro-industrial residues, and wastes of farm animals [17]. The soil bio-fumigation gave promising results to control plant-parasitic nematodes, soil-borne pathogens, insects and weeds [17,18].

On the other hand, one of the exclusive approaches is using dried waste residues of certain ornamentals [19-22] and vegetables wastes [14] as soil amendments. Similarly, amended soil with weeds and /or medicinal plants such as *Chenopodium ambrosioides*, *Euphorbia peplus* and *Rumex dentatus* as green leaf manures gave significant influence against root-knot nematodes [23].

Through the points that have been mentioned, we can be certain that the additions of organic matter to agricultural soils from whatever source have good impacts. The suppressive effects of soil amended with plant wastes to manage phytonematodes have been attributed to the release of Phytochemical constituents during the decomposition in soil. For example of nematotoxic compounds cyanogenic glycosides, quinines, saponins, triterpenoids, flavonoids, alkaloids, sterols, tannins [24-28]. Meanwhile, all soil amendments have direct and positive effects on the soil micro-organisms which play indirect role in management strategy.

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