Innovative Biofumigation Technologies for Soil Risk Assessment.

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SUMMARY

We adopted new innovative technologies to develop sustainable soil-borne disease management tactics suitable for use in organic or Global GAP vegetable and fruit production systems. We aimed to develop tactics that build healthy soils and promote microbial ecosystems that challenge these potentially devastating, broad spectrum pathogens. We adapted three innovative approaches of synergistic biofumigation (Syn-Biofum) to control soil-borne diseases, root-knot nematode and aggressive weeds. Our approaches are synergistic physical-biofumigation, synergistic biocontrol-biofumigation, and synergistic chemical-biofumigation. These technologies can efficiently suppress soil-borne diseases, plant parasitic nematodes, and aggressive weeds instead of Methyl Bromide (MB). These new technologies are eco-friendly, safe, cheap and can work under organic agricultural and global gap systems worldwide. We are working by these technologies here in Egypt and we developed 2 Eco-friendly biofumigated compost companies that produce more than 360,000 ton/year. This is a unique technology and we are working across Egypt in Organic and global gap agricultural systems.

INTRODUCTION

Biofumigation refers to the suppression of soil-borne pests and pathogens by biocidal compounds, particularly isothiocyanates (ITCs), released from brassicaceous rotation and green manure crops when the glucosinolates (GSLs) in their tissues are hydrolysed in soil **(Salem, 2012; Salem *et al.*2012a; Salem *et al.* 2012b).**

Modified Biofumigation exploited by **Salem, 2014** and it is refers to using a new technology of modified synergistic-biofumigation in controlling soil-borne pathogens, root-knot nematode, and aggressive weeds. Our research has investigated the potential to exploit the modified biofumigation approaches by three synergistic biofumigation technologies that can adapted to different soil conditions and different geographic farms in Africa and Asia. Some hydrolysis products, particularly the ITCs are known to have broad biocidal activity including insecticidal, nematicidal, fungicidal, antibiotic and phytotoxic effects.

Successful production of agricultural crops depends upon the control of soil-borne pathogens, which used to be managed by soil fumigation with methyl bromide (MB). Control of soil-borne pathogens by biofumigation is based on the action of volatile compounds, essentially isothiocyanates (ITC's), produced by the hydrolysis of glucosinolates which are found within Brassicaceae **(Angus *et al*., 1994; Kirkegaard & Sarwar, 1999; Salem, 2012).**

RESULTS and DISCUSSION

We adopted new technologies for biofumigation and defined new terminology called Synergistic Biofumigation (Syn-Biofum). This paper will describe three main mechanisms as follows that can efficiently suppress soilborne diseases, plant-parasitic nematodes, and weeds in different soil types worldwide. A simple example; in European countries, most of the agricultural soils are mainly acidic soils while on the
other hand, most of the African and Middle East countries are mainly alkaline soils. So, for this is the reason new technologies were selected to modify biofumigation to be an efficient substitute for Methyl Bromide in controlling the three main problems, i.e. soil-borne plant diseases, plant parasitic nematodes and parasitic weeds. As we worked with these modified techniques of Syn-Biofum, we succeeded in solving these fatal problems in Egypt, Sudan, Tunisia, Ghana, Kingdom of Saudi Arabia and Pakistan, and we will show clearly those three new technologies that were adopted for Soilborne diseases, nematodes, and weeds.

The modified mechanisms investigated were:

1. Synergistic Physical–Biofumigation

2. Synergistic Biocontrol–Biofumigation

3. Synergistic Chemical–Biofumigation

We have to declare that each mechanism has certain advantages and can be recommended under certain conditions. We will emphasize the share our experience in these novel technologies and its recommended applications to be used worldwide for controlling those above mentioned soil problems.

CONCLUSIONS

We could conclude that our new innovative biofumigation technologies can be used worldwide to cope with different soil conditions either alkaline like those in the Middle East or acidic soils like those in Europe and to solve not only the soil-borne plant pathogens but also both root-knot nematode and aggressive weeds. Moreover, our modified technologies can be adopted and work efficiently against these soil contaminations by those pathogens and pests compared with other chemical pesticides i.e. Methyl Bromide that was banned since,2005 that cannot used in both Global GAP or Organic agriculture systems. Finally, our innovative, modified biofumigation technologies are eco-friendly and cheap, feasible and can be applied worldwide.

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