

Prospects of Biological Control of Plant Diseases in Ghana: A Mini-Review

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Abstract

Plant pathogens need to be controlled on disease plants in order to obtain maximum yield and to ensure food security. By doing so, practitioners should be mindful of the appropriate control options available and their effects on the environment and human health. Plant diseases can be managed by either chemical pesticides, regular agronomical practices (cultural control), biological or judicious combination of all available options in an integrated manner (IDM). Though the combination of the chemical option with the cultural are effective, fast and reliable, the former causes both environmental and health hazards. Moreover, much attention has not been paid to the biological control option which is considered as safer and devoid of risk as biocontrol agents or their secondary metabolites are neither phytotoxic nor hemotoxic. This mini-review reports on the prospects of using microbial antagonists as biological agents for the control of plant diseases in Ghana. Even though this is a short review, it is very important since it is going to create awareness especially to policy makers of the impact of synthetic pesticides on agriculture and health and the need to find alternative control option which is more environmentally friendlier and devoid of human risks.

Keywords: Biological control; Biotic stress; Chemical pesticides; Bioengineering; Biotechnology

Abbreviations: IDM: Integrated Disease Management; Biocontrol: Biological Control

Introduction

Ghana is an Agrarian country with its population dependent on agriculture for livelihood. Agriculture in our country is basically rain-fed and the use of technology is virtually non-existent. Biotic stress accounts for about 35% yield reduction mainly through pests and diseases during production. To bring these agents under control, illiterate farmers with no knowledge in plant protection use any available means including chemical pesticides to control these biotic factors without considering their effect on human health and the environment. They tend to not only abusing these synthetic pesticides but also misusing them and at the mercy of the environment and human health. Even though these chemicals are effective, quicker and reliable [1], but they are not without side effects. Biological control of diseases caused by plant pathogens compared to chemical control or biological control of insect pests are not fully developed and exploited even though more research and effort are being invested due to its high potential. Currently, countries such as the USA, Australia and New Zealand are using commercially available biological control products [2,3]. Biological control offers safer and environmentally friendlier control option. In this mini-review, light is thrown on the prospects of biological control option as an alternative to chemical control of plant diseases in Ghana.

Prospects

In the last decade, efforts are being made to shift from chemical control to biological control using microbial antagonists. Biological control is the use of an antagonist (a whole or its parts), its metabolic secondary waste to prevent, protect or control plant diseases. Biological control uses several mechanisms such as antibiotic production, inducing

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resistance in the host, competing for limited resources, parasitism, and promoting plant growth thereby protecting the plant from pathogens attack [4]. Not much success has been achieved in the area of biocontrol technology in Ghana since there is no policy on the part of the government to focus and direct scientists into this area of bioengineering and biotechnology. This does not also mean nothing at all has been done in this area, there are therefore few examples of the use of biocontrol agents either in a controlled environment or in the field. One such example is a pioneering role of Attafuah [5] using *Pseudomonas aeruginosa* (Schröter) Migula against *Phytophthora palmivora*, the causal agent of cacao black pod rot disease. This was followed by Odamtten, et al. [6] using *Aspergillus niger* and *Trichoderma viride* also against the cacao black pod pathogen.

Akrasi et al. [7-9] have also shown that given the needed attention and support, native rhizobacteria can be exploited for the control of plant diseases, especially for fungal cacao diseases. Much attention is being focused on cacao fungal diseases since cacao is the main backbone of the Ghanaian economy and fungal diseases are the main problem confronting the industry. Currently, there is a serious focus on the part of Larbi-Koranteng et al. [9] trying to change the direction of plant diseases management in Ghana using the biocontrol option. The approach is on using modern techniques in molecular biology, computing, analytical chemistry and statistics to enhance the future of biocontrol engineering. This perspective is concentrating on defining new techniques that will be able to characterize structures and functions of biocontrol agents, pathogen variability and the host plant at the molecular, cellular, organismal as well as ecological levels to ensure that Ghanaian food becomes safer devoid of pesticides and environmental pollution.

Conclusion

There is no doubt about the threat of plant pathogens to crop production and food security. For that matter, diseases causing agents need to be controlled if we want to reduce their effect on yield. However, the focus has been on the use of chemical control

option at the expense of other control measures which are safer and environmentally friendlier. Control measures based on the use of this option is biocontrol engineering to manage crops from pathogens attack, thereby increasing yield. There is a great potential in this field and if seriously considered, it will not only complement but also replace the over-reliance of chemical/synthetic pesticides in agriculture.

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