Organic Farming

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Edited by
Dr. Sushma Gupta

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Preface

Organic farming is a system of agriculture that uses environmentally sound techniques for raising crops and livestock that are free from synthetic compound. The methods used in organic farming seeks to increase long term soil fertility, balance insect and organism populations and reduce air, soil and water pollution while maintaining or increasing levels of production. As opposed to the conventional farming system, organic farming keeps the welfare of every player in mind including the provision for fairness in farm situation and in trade. It stimulates the societal and individual responsibility for the environment hence sustainability.

Consumption of organically grown food products is gaining currency the world over. This has led to a keen interest in sourcing from India, considering that a major part of agriculture in our country is organic by default. The challenges in this emerging market are lack of information with the growers, difficulty in acquisition of the requisite knowledge and absence of market linkages. The multiplicity of standards varying from country to country and lack of focused attention to this emerging sector add to the complexity of participation by small farmers in this potentially huge market opportunity. With the diverse native plant species, traditional low external input, high human crop husbandry methods, the blessings of a variety of agro-climatic zones and long periods of sunshine, India can emerge as a major supplier of organic food to the whole world.

The main objectives of publishing the book are to

(i) Discuss opportunities and options for small farmers in organic agriculture.

(ii) Provide insight into the dimensions and requirements of the export and domestic organic foods market.

(iii) Update knowledge on organic agricultural practices, their codification and adoption.

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(iv) Understand the role and functions of various promotional agencies in encouraging organic agriculture.

(v) Create awareness about the certification standards and procedures to obtain certification.

(vi) Highlights the key role of banks in promoting and popularising organic agriculture, particularly among small farmers, and encourage farmer-to-business and business-to-business interaction, which has the having potential for commercial opportunities benefiting small farmers.

Dr. Sushma Gupta

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Acknowledgement

Acknowledging contribution made by everyone who has helped me in the preparation of this book is most auspicious for me.

I express my sincere and whole hearted thanks to the patron, Swami Sadanand Ji, President College Managing Committee for his continuous guidance that motivated us to perform the whole work with ease. I have no words to acknowledge my sincere thanks and appreciation to members of managing committee for their cooperation and support during the whole work.

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Above all I am thankful to the "Almighty" for showering his blessings on me to complete this work.

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Role of Chemistry in Sustainable Crop Protection: A Review

Dr. Amita

Abstract

Chemistry has been vitally important for crop protection. Control of fungal pathogens, insect pests and weeds is crucial to enhanced food provision. As world population continues to grow, it is necessary to assess the current situation, anticipate future challenges and consider how new chemistry may help meet those challenges. In future, agriculture will increasingly be expected to provide not only food and feed, but also crops for conversion into renewable fuels and chemical feedstocks. In order to contribute to programmes of integrated crop management, there is a requirement for chemicals to display high specificity, demonstrate benign environmental and toxicological profiles and be biodegradable. It will also be necessary to improve production of those chemicals, because waste generated by the production process mitigates the overall benefit.

Introduction

As a society we are receiving clear signals that some chemicals routinely used in conventional agriculture are associated with alarming health and environmental effects. From human to ecological health impacts, there are growing concerns about how we farm. In contrast, 'Sustainable Crop Protection' describes a balanced agricultural system to which many increasingly aspire. Though chemistry applications for sustainable agriculture are relatively few, there is a specific area within green chemistry that

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has direct implications for sustainable crop protection[1]. Green chemistry and sustainable agriculture are both revolutionary fields. Sustainable agriculture encompasses a wide variety of farming techniques and seeks to achieve three goals: farm profitability; community prosperity; and environmental stewardship. The latter includes: protecting and improving soil quality, reducing dependence on non-renewable resources, such as fuel, synthetic fertilizers and pesticides and minimizing adverse impacts on safety, wildlife, water quality, and other environmental resources. Green chemistry is "a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products" and is based on renewable feedstocks, where toxicity is deliberately prevented at the molecular level. Both of these fields speculate safe products, healthy people, a clean environment, and most importantly, a systemic approach to sustainably producing what we need. Green chemistry and sustainable agriculture are inherently intertwined; farmers need green chemists to make safe agricultural chemical inputs. Green chemists need farmers practicing sustainable agriculture to provide truly "green" bio-based raw materials to process into new products. Green chemistry has been the mainstay of crop protection strategies for arable farming and food production. The control of fungal pathogens, insect pests and weeds has made a crucial contribution to food provision worldwide by ensuring the harvested yield of the world's crops. As we make progress in the new millennium, it is timely to take stock of the current situation and to look forward to future improvements that may be provided by new chemical technologies. Iin future, chemical inputs will be vital and obligatory to maintain and improve yields. Optimized yields make a major contribution to agricultural sustainability. Loss of yield in one area needs to be replaced by imports of food and materials with consequent use of fuel for transportation, and this is in addition to expansion of the land area required to provide an equivalent crop yield. Whereas crop protection treatments are available for almost all of the problems that affect crops, improvements in performance are required to achieve sustainability goals and this review will discuss avenues for achieving these. Contributions Made to Agriculture by the Chemical Technologies

The future for chemical crop protection is subject to a number of pressures that could result in a reduction of new chemical

entities reaching the marketplace[2]. The regulatory hurdles that form a necessary part of the licence to sell are ever increasing. Whereas this is a natural and in many cases desirable trend. An important feature of the industry is that, for the first time, there has emerged a successful widely applicable alternative to chemical technologies. Since 1996, biotechnology has contributed to the commercial development of gene-based self-protection of plants, where crops are genetically modified to express insecticidal and fungicidal proteins or resistance to a herbicide. In addition to both the biological and economic effectiveness of such strategies[3, 4]; there is great advantage in that sophisticated technology is embedded in the seed, which, in turn, can be grown by conventional local farming practice. This elegant placement of the technology can be seen as a powerful extension of chemical seed treatments and presents an alternative to spraying. The adoption of such gene-based technologies by farmers and growers has been unprecedented Another chemistry-based alternative to conventional crop protection treatments is provided by the use of semiochemicals, such as pheromones and food attractants. Such methods can provide a number of advantages in terms of sustainability. Typically, semiochemicals are relatively simple naturally occurring organic molecules that could be provided by biosynthesis as well as conventional organic synthesis. They are highly active and very species specific. In spite of these advantages, these methods have enjoyed relatively limited success to date and are often best suited to niche uses such as applications in confined environments or in monitoring pest populations. The challenge for the future is to develop optimized combinations of chemical, gene-based and biological control methods to provide sustainable integrated crop management regimes relevant to the widely differing agricultural practices across the world. Chemistry in Crop Protection

Chemical strategies will form the mainstay of crop protection for the future because there is no widely applicable alternative to chemical herbicides. Herbicides constitute over half of the market for crop protection chemicals. However, the industry will have to introduce new chemicals to fit in with the changing agricultural environment. There are many reasons to explain why chemical treatments will achieve success in the coming years. The development of resistance by pests and weeds to current molecules will ensure that new products displaying novel biochemical modes of action will be highly prized. Resistance to families of insecticides

and fungicides is already widespread, and crop protection has relied upon continued elaboration of new molecules. Even in the herbicide arena, commercial levels of resistance are now appearing[5], Glyphosate, by far the world's most used herbicide, is beginning to display this effect[6]. The latter finding is potentially very serious in that engineered tolerance to glyphosate forms the basis of the vast majority of herbicide-resistant crops. In spite of a massive amount of discovery research over three decades, the industry has been unable to identify a replacement herbicide with properties as advantageous as glyphosate. Products with novel modes of action are characterized by rapid uptake in the market and can command premium prices. As such, they represent prime targets for invention.

Modern Crop Protection Chemicals

Modern crop protection chemicals meet the precise requirements relating to human health and environmental protection in addition to effectiveness. Factors that are important to sustainable farming are the requirements for inclusion in integrated crop management programmes. Thus, the invention process has needed to be adapted not only to meet these requirements but also to provide safety factors of several orders of magnitude. As a consequence, new indicator tests have had to be developed for introduction into various stages of the process.1. The invention process starts with two key requirements. First is the choice of a target that fits the strategy of the organization undertaking the development and which is defined in terms of the biological effect required to deliver the desired benefits. Second is the elaboration of chemistries that provide the profile of a premium product. This profile includes supporting the sustainability of the whole chain of food production activities.2. A major cost in the development of a new crop protection chemical product relates to environmental safety. In addition to safety to animal species, products must be benign to non-target species ranging from aquatic species through to beneficial insects such as bees. The chemical must persist long enough to provide a premium effect but must not persist as a residue in the environment. These parameters are particularly difficult to balance in soil—generally a harsh environment for chemical stability. Persistence is a property that can be predicted from model studies and physico-chemical data. Model experiments for soil half-life, hydrolysis and redox potential are readily established in rapid throughput format. In this way,

chemistry can be guided into areas with favourable environmental properties. Using model experimental systems the prediction of leachability can be made. These include rapid high-throughput assays based upon simple chromatography on various soil types through to large-scale lysimeter studies. As part of the development process, there will be numerous large-scale field trials to test the effects on non-target species, and it is these that will be the major contributors to sustainable treatments and consequent regulatory approval.3. The most important feature of a new agrochemical is that there should be no adverse effects on human health. The regulatory framework pays immense attention to this aspect, and a regime of studies, both *in vitro* and *in vivo*, in animal models is required to gain the licence to sell. In specific cases, human volunteer studies are conducted, albeit in the latter stages of development. It is ironic that this most important factor is also the most difficult to model at the early stages of research. There are a number of *in vitro* indicators such as the Ames Test for mutagenicity, but these are incomplete indicators and often not amenable to high throughput and rapid reporting. The metabolic fate of chemicals in humans can be investigated using, for example, simulated gut fluids and blood preparations.There is significant current interest in the application of toxicogenomics, in which changes in gene expression in response to chemical challenge can be measured in a microarray format[7,8,9] whereas this field is at an early stage of development, one advantage is that expression arrays of human genes can be employed. It should be noted that at best the technique will only provide early alerts and normally in comparison with a known toxicological effect. Furthermore, many types of toxicology are not amenable to this approach. Investigative toxicology employed at a molecular level holds much promise for studying human safety. Here, the molecular mechanism of a toxicological response is elucidated and the enzymes involved in the pathway are used in *in vitro* assays. Again, human proteins can be included in such tests.

Conclusions

Modern methods for production of crop protection chemicals should ideally be atom efficient, be safe, have only one step with no solvent, generate minimal waste, have minimal energy requirement, be based on renewable resources and be environmentally benign. Such 'green' synthetic routes might involve use of recyclable catalysts, recyclable and more benign solvents

and/or alternative energy sources. Advances have been made in all of these areas.

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Vermiculture: A New Approach Towards Organic Farming

*Dr. Ashwani Kumar & **Prabhjyoti

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1. Abstract

Farmers depend upon chemical fertilizers for their crops all over the world. Now a day, the trend of organic farming is increasing especially in developed countries. Moreover in these countries the Government is promoting the farmers for organic farming. There are many human diseases which are directly and indirectly associated with the chemical fertilizers. To improve the human health, the organic food plays a very important role. One of the most important categories of organic food which is produced by using the living organisms (earthworms) is Vermiculture. The technique of rearing and culturing earthworms is called vermiculture and the casting product of earthworms is vermicompost. Vermicompost is applied on plants to prepare the organic food. Organically prepared food is very important and nutritious for human health and to control the diseases.

2. Introduction

Food is the basic necessity of all living organisms. We cannot survive without food. Continuous supply of healthy food for increasing human population is of great concern. On the other hand, farmers all over the world rely on chemical fertilizers for increase in crop yield which adversely affect the health of human beings. There are other eco-friendly methods which should be used for increasing crop yield e.g vermiculture, organic farming etc. These methods are not harmful for human beings. Vermiculture is a new