

Editorial

Biopesticides – one of the elements of organic farming

The intensive use of pesticides in agriculture is a cause of serious concern. The problem is especially serious because of the development of resistance to pesticides in important pests and the presence of pesticide residue in agricultural and dairy products. Pesticide resistance in agriculture was first noticed in India in 1963 when a number of serious pests were reported to have become resistant to DDT and HCH (two of the most commonly used pesticides during the 1960s and 1970s). Since then the number of pests with pesticide resistance has increased. The most serious problem of resistance is witnessed in cotton, for which American bollworm is a serious pest. The bollworm has developed resistance to almost all pesticides in a number of regions, and is particularly serious in parts of Punjab, Haryana, Andhra Pradesh, Karnataka and Maharashtra.

It is clear that the excessive use of chemical pesticides in agriculture is a serious cause of concern. It is, therefore, important that alternative, environmentally friendly methods of plant protection are adopted, such as integrated pest management (IPM) techniques, including the use of biopesticides.

The main factor driving demand for organics is a growing awareness of deleterious effects of indiscriminate use of synthetic inputs in conventional farming. Recognition of water contamination associated with indiscriminate use of chemical pesticides is also a factor.

Globally, it is estimated that about 272 million hectares of land is agricultural land. Of this, the organically cultivated area represents about 24 million-hectares, or approximately 9% of total of agricultural area. More than 50% of this area includes grazing land under dry land conditions, uncultivated woodlands, and other wild areas from which wild plants are harvested. (about 11 million hectares in Australia, and 3 million hectares in Argentina, fall in this category.). With the exception of a few countries, areas devoted to organic farming constitute less than 5% of the total farming area in most of the countries, and less than 1% in many countries, including the US. Therefore, there is a lot of room for growth in organic farming and hence in biopesticides.

Biopesticides are living organisms (plants, microscopic animals such as nematodes, and micro-organisms, including bacteria, viruses, and fungi) or natural products derived from these organisms, that are used to suppress pest populations. The main advantages of biopesticides are reduced environmental damage and potentially lessened risk to human health. They can also offer more-targeted action against specific pests, thereby reducing risks to other species such as birds and mammals. Furthermore, pests are more likely to develop resistance to biopesticides than to chemical pesticides. On the other hand, chemical pesticides can offer effective activity much more quickly, whereas biopesticides may require time after application to take effect. Integrated pest management approaches can reduce the use of the chemical pesticides, minimizing or at least diluting the negative factors associated with either chemical or biopesticides, while drawing on strengths of each.

Biopesticides are generally applied as liquid base formulations, water-dispersible granules, wettable powders, or pellets. Formulations are based on ease of application, end-user preferences, and the type of dispensing equipment available. Often the same product can be manufactured in all four formulations; field requirements will dictate the particular choice. Liquid-based formulations hold the major share of the market (- 60%), followed by granules, then powder.

The most commonly used biopesticides include *Bacillus thuringiensis* (Bt), Baculoviruses and neem. In addition to these, *Trichoderma*, which is a fungicide, is also used. Biocontrol agents, such as *Trichogramma*, are parasites and predators of pests and their eggs.

Pseudomonas fluorescens is a soil bacterium that controls the growth of plant pathogens. *P. fluorescens* is effectively used against many several fungal, viral, and bacterial diseases. *P. fluorescens* is used for many crops, including cereals (paddy, sorghum, cumbu), pulses (black gram, green gram, bengal gram, red gram, peas), oilseeds (groundnut, gingelly, sunflower, mustard, castor, soybeans), and vegetables (bhendi, radish, cauliflower, cabbage, beetroot, gourds). The bacterium produces plant-growth-promoting substances, such as the auxin indole-3-acetic acid, and antibiotics. *P. fluorescens* is used as a biofungicide for controlling many kinds of fungal, viral, and bacterial diseases.

The global weighted average consumption level of biopesticides is approximately 1 kg per hectare. With the global organic farming area comprising about 24 million hectares, global biopesticide consumption is thus estimated at about 24 million kg translating into a global market for biopesticides of approximately \$672 million. The overall growth rate of biopesticides is estimated to be about 10% per annum for the next 5 years.

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