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A REVIEW STUDY ON PEST CONTROL IN ORGANIC SYSTEMS

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ABSTRACT

In comparison to conventional farming, organic farmers have fewer choices for managing pests and illnesses in their crops due to organic farming laws. Major pests, on the other hand, may be controlled by manipulating agro ecosystem processes to the benefit of crops and to the detriment of pests. Because of the restricted number of active plant protection chemicals approved for use in organic farming, natural and biological control agents may assist in pest and disease suppression. Traditional agriculture techniques used in recent decades have had unfavorable effects on environmental sustainability, including soil erosion, ecological system degradation, changing the balance between beneficial and harmful pests, and heavy metal and pesticide contamination of soil, water, and agricultural products. As a result, employing synthetic pesticides for pest management is banned in organic agriculture, emphasizing the importance of variety. The study offers the reader with a wealth of practical information that is well-documented and helpful to academics and farmers all around the globe. In organic agriculture, pest management may be achieved via both preventative and curative measures, but contemporary agriculture must prioritize prevention.

KEYWORDS: *Agriculture, Organic Agriculture, Pest Control, Preventive, Pesticides.*

1. INTRODUCTION

Organic agriculture (OA) farming seeks to create sustainable, diverse, and balanced systems in order to preserve the environment for future generations. OA also offers goods on the food market that are of a particular nutritional grade and are minimal in pollutants. Organic products are regulated by a set of well-defined standards that seek to ensure crop and environmental sustainability[1]–[5].

1.1. Pest control situations in organic systems:

The goal of OA, as a form of sustainable agriculture, may be described using a mini–max function, which maximizes output while reducing the negative effects of agricultural operations on the environment. The activity of beneficial microbes, flora, and fauna is stimulated by OA. Crop-growing soils are becoming more lifeless and plagued with weeds, illnesses, and pests. Current agricultural methods, which excel in monoculture and short crop rotations of 2–3 years, significantly delayed and poor quality soil tillage and plant care, burning plant waste, and so on, have contributed to this scenario[6]–[8]. Biodiversity conservation is a hot topic these days. The biological resources of the soil are critical to humanity's economic and social progress. As a result, biological variety is increasingly regarded as a universal endowment with incalculable worth for future generations. Biological (ecological, organic) agriculture employs a larger number of farmed species in order to investigate their appropriateness and ecological adaptability. The use of gentler weed-killing treatments rather than synthetic pesticides guarantees that weeds and crops coexist.

Taking care of the natural environment. Elevation variety, as well as flora and fauna heterogeneity, are inextricably linked to the applicable vegetable growing methods, with the most aggressive being intense, which often results in degradation. Many agricultural methods used in recent decades have had unfavorable environmental effects, leading to soil erosion, ecological system deterioration, and pesticide and nitrate pollution of ground water and crops. Organic agriculture seeks to keep the environment as natural as possible by utilizing organic fertilizers, as well as less soluble mineral fertilizers, organic fertilizers, such as composts and green fertilizers, and avoiding the use of hazardous chemicals.

The use of synthetic herbicides and pesticides is banned, and only plant-safe products, such as those based on simple minerals (Cu, S, Na, silicate, etc.) or plant extracts (pyrethrum), as well as the use of physical (thermal) techniques, are permitted. When opposed to conventional agriculture, the focus in organic agriculture is on the quality of human intervention over nature, which is non-aggressive[9]–[11].

1.2. Organic agriculture standards and regulations:

After 2010, OA can be considered a period of consolidation for standards and regulations, with the goal of reducing legislative gaps between various certification types, such as the EC Regulations [3, 4], the USA (NOP), Australia (AS 6000-2009), Japan (JAS), and Switzerland, in order to facilitate international trade with organic products (Bio Swiss). As a result, the European Commission's organic agricultural legislation has been enhanced in recent years with new rules focusing on aquaculture and organic wine production. The number of certifying organizations increased to 569 in 2013, up from 532 in 2010. The European Union, Japan, the United States of America, South Korea, China, Canada, India, and Brazil are home to the majority of certifying organizations.

Organic farming (biological, ecological) is one of the most dynamic agricultural practices today. The development of agricultural regions, which now account for 40.2 percent of the surface area in Oceania, 26.6 percent in Europe, and 15.3 percent in Latin America, bolsters this assertion. There are other nations, such as Argentina, Spain, and the United States, where the area grew by about 185,000 hectares in 2013 compared to 2011. At the end of 2013, the organically certified area reached more than 78 million hectares across the globe. Organically certified agricultural lands totaled about 43 million hectares (1 percent of total arable land), including the same land throughout its conversion phase, although wild gathering and aquaculture were not included. According to these figures, the organically administered surface has grown at a pace of nearly 14.94 percent since 2012. (Approx. 37.4 million ha). In comparison to 2011, Europe and Oceania had the highest rate of land growth in 2013, indicating that the development of regions is aided by intense marketing of organic goods. In comparison to 2012, the world's organically certified area grew by approximately 5.6 million hectares, implying a 0.1 percent rise in arable output from the overall agricultural area. At the end of 2013, the organic agricultural area was divided into three categories: permanent grassland, arable land (cereals, green fodder, oilseed, vegetable, and protein crops), permanent crop land (coffee, olives, almonds, grapes, and cocoa), and other crops.

1.3. Pest-control strategies:

Organic farming (OF) is an agricultural production method that works with natural processes rather than against them. Soil fertility, weeds, diseases, and pest management are the main technological changes that have been developed between organic and conventional plant production. Insect management in organic agriculture may be achieved via both preventative and therapeutic measures, although the emphasis must be on preventing pest infestations. Pest infestation prevention measures include: phytosanitary quarantine (special for seed and planting materials used for establishing crops); pest infestation monitoring (used in general agro-expert stations or traps); cultivar selection based on resistance and ecological plasticity criteria; seed

conditioning; weed destruction; solarization; and hygienic conditions.

1.4. Pest control in organic systems:

Organic systems (OS) should address the process of modifying their biocenosis (total community of organisms from a biotope) via the correlation and interaction between farmed species, diseases, weeds, pests, technology, and the environment as a basic concept of pest management. Due to the wide range of pathogens and pests that these crops attract, protecting plants from pests and diseases has the biggest effect on attaining an organic vegetable harvest. Even before 1970, when the idea of integrated control was pushed, the first significant effort to minimize chemical treatments took occurred. According to this idea, all technological techniques are permissible for maintaining pest and disease populations at a level of impairment that does not impact yields from an economic standpoint. The International Organization for Biological Control (IOBC) has accepted this idea, however natural factors must be utilized first, followed by additional techniques that are suitable for the economic, ecological, and toxicological criteria. Extreme weather circumstances, as well as a poor choice of planting season.

1.5. Phytosanitary quarantine:

The quarantine is a set of preventative measures used to prevent the spread of illnesses, pests, and weeds brought in from other nations. Overall, export goods between nations must be accompanied by a phytosanitary certificate stating that the seeds or agricultural materials used to establish the crop (seeds, cuttings, tubers, bulbs, seedlings, shrubs, or trees) are pest-free.

1.6. Biodiversity preservation:

Organic farming does not allow the use of synthetic pesticides, which helps to maintain and increase biodiversity in the system. As a result, natural enemies of pest species may flourish and exercise control over pest populations. Conservation and enhancement of natural landscape elements such as hedgerows and ponds, as well as the creation of beetle banks and planted flower strips, have allowed predatory populations to thrive. Farmers deal with biological creatures in general, which respond differently under the influence of biotic and abiotic elements in nature. Cultivars are chosen based on resistance and ecological plasticity parameters. The cultivar is perhaps the most significant element in determining production and quality. It will be stated in terms of suitable measurements due to its biological and technical possibilities.

The farmer should consider the following factors when selecting the best cultivar for OA: consumer preferences in terms of appearance, taste, and other factors; climate and soil conditions, adaptation to extreme environmental conditions; extreme temperatures, the length of the photoperiod, tolerance to high salt concentrations, and cost-effective fertilizer use; and resistance or tolerance to diseases. And the final destination of the product: fresh consumption and industrialization (canning, freezing, dehydration, and so on);

A cultivar cannot satisfy all of these criteria, but the most appropriate biological material will be selected in the given circumstances, based on the destination of the goods and both the customers' and farmers' preferences. Depending on the size of the surfaces and the destination of the goods, producers have quite varied needs for variety characteristics. Large fruit species may therefore be grown in tiny gardens established by amateurs for their own use, since they are more sensitive to transit and storage. OA varieties, hybrids, local populations, and clones are OK, but genetically modified species are not.

1.7. Crop surveillance:

In organic agricultural systems, bug monitoring is critical (OFS). One of the most important actions of management choices that leads to the optimum time is the correct identification of insects and insect biology knowledge when they invade crops. This may be accomplished by

simply inspecting the crop for pests (aphids, spider mites) or by using pheromone traps (thrips, cydia, white fly, rose fly, carrot fly and cabbage moth).

1.8. Pest control, management techniques are important.

Cultural activities in organic farming may be as precise as crop production techniques that are adopted early in the organic farm plan to minimize the risk of insect pest infestation. These methods are based on interrupting the pest's biological cycle in the following ways: making a crop inaccessible to pests in terms of space and time; making a crop undesirable to pests by interfering with location; decreasing the pest's impact on the crop via natural enemies, and so on. Cultural practices are one of the oldest pest-control methods, and many of the activities employed in conventional and organic farming today have their origins in traditional agriculture. The effective use of cultural strategies requires a thorough understanding of pest–crop interactions as well as the pests' natural enemies.

1.9. System of intercropping:

Growing two or more crops (typically from different families) in the same area is known as intercropping. Strip cropping is a kind of intercropping in which two or more crops are planted in alternating strips over a field. Both methods help to enhance biodiversity while also making the environment less conducive to pest growth.

1.10. Management of tillage:

Tillage techniques may affect a large portion of the insect population, both soil and foliar. Insect pressure in subsequent crops is reduced by tillage methods. Many insects are in the overwintering stage inside the soil or in crop residues when fields are tilled in the autumn or early spring. Many insects are killed by direct contact, starvation, or exposure to predators, as well as disruption of the insect life cycle, which includes direct destruction of the insect or its overwintering chamber, removal of the protective cover, elimination of food plants, and disruption of the insect life cycle. Sprinkler irrigation decreases the amount of pests in crops. Culvert irrigation decreases the amount of galas in the soil, causing the biological cycle of soil insects to be disrupted.

1.11. Mulches:

Mulch is a layer of material put to the soil surface for a variety of purposes, including moisture conservation, improved soil fertility and health, weed control, and pressure soil land crop infestation with various pests. Mulch is typically, but not always, organic in origin (Figure 6a). It may be biodegradable or non-biodegradable (for example, plastic sheeting) (e.g., bark chips). It may be used on bare soil as well as around existing plants. Mulch made out of manure or compost is organically absorbed into the soil by the action of worms and other organisms.

1.12. Crop health at its best:

Healthy living soil is the driving force behind organic farming's long-term viability and environmental protection. Microbes in the soil break down organic materials to create a balance of minerals and nutrients that plants need to produce healthy, vigorous crops. When this equilibrium is reached, the crop's overall health improves, making it more resistant to pest and disease assault. Crop husbandry and cleanliness also contribute significantly to the crop's health and the avoidance of insect issues.

1.13. Treatment options:

Curative care, also known as curative measure, is health care provided for environmental circumstances in which a measure is thought to be attainable, or perhaps potentially achievable, and is oriented toward that goal. Curative treatment varies from preventive care, which focuses on decreasing the severity of the assault rather than avoiding the development of pests.

1.14. Mineral insecticide preparations

The cabbage aphid and mites (red spider) are both effectively controlled using potassium soap. The therapy is given to the plants repeatedly with different solution types, either alone or in conjunction with other goods (horsetail extract). 200–300 g soap + 0.5 l alimentary alcohol + 1 table-spoonful of lime and 1 table-spoonful of cooking salt in 10 l water (lice); 200–300 g soap + 0.5 l alimentary alcohol + 1 table-spoonful of lime and 1 table-spoonful of cooking salt in 10 l water (red spider and Colorado beetle larvae); 200–300 g soap + 0.5 l alimentary alcohol + 1 table-spoonful.

2. DISCUSSION

In comparison to conventional farming, organic farmers have fewer choices for managing pests and illnesses in their crops due to organic farming laws. Major pests, on the other hand, may be controlled by manipulating agro ecosystem processes to the benefit of crops and to the detriment of pests. Because of the restricted number of active plant protection chemicals approved for use in organic farming, natural and biological control agents may assist in pest and disease suppression. This chapter discusses organic farming's crop protection concepts and methods, as well as the cultural practices used, the active chemicals permitted for pest control, and the effects on faunal and floral biodiversity.

3. CONCLUSION

In organic farming, crop protection is more of a preventative measure than a cure. Crop rotation, fertilization, cultivation, the use of resistant cultivars, and the maintenance of natural enemies all play important roles in pest management. Plant protection products (PPPs) that are allowed in organic farming should only be used when cultural and biological measures fail to keep pest populations under economic harm thresholds. Floral and faunal diversity is the cornerstone of an organic agricultural system's pest and disease management approach. Organic farming's crop protection program must be recorded in order for inspectors to submit their reports, which are required for certification. A well-written strategy, copies of scouting records and procedures used in pest monitoring, and the supply of pest management recommendations, according to organic standards, if applicable, are all required papers. Future research objectives and suggestions for improving pest control methods in organic farming.

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