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EXPLORING PESTICIDE APPLICATION PRACTICES FOR MANAGING PROMINENT AGRICULTURAL PESTS IN AND AROUND TENKASI

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Abstract:

This study, conducted between November and March in the Tenkasi district, examined pesticide usage in relation to crop cultivation in Shencottai, Sundarapandiyapuram, Sambavarvadakarai, Panboli, Kadayam, and Surandi. Sunflower, coconut, raw banana, paddy, and potato were the prominently cultivated crops. Pesticides like neem oil, FAME, carbaryl, coragen, malathion, and dimethoate were employed based on specific crops, showcasing diverse pest management strategies. Analysis revealed Dimethoate as the most extensively used pesticide, underscoring its significance in pest management during the study period. The study highlighted the broader ecological impact of pesticides, emphasizing risks to wildlife and plants. Ecotoxicology, focusing on pesticide impacts, was introduced. The study noted the far-reaching effects of pesticides, considering runoff, wind drift, and the persistence of certain pesticides like DDT and chlordane. Plants' absorption of pesticides through roots and leaves indicated their susceptibility. The cumulative impact on individual plants and animals underscored the need to address potential ecological consequences. In the study urged a careful evaluation of pesticide usage, considering environmental impacts. Adhering to label instructions and exploring alternatives with lower toxicity was advised. Integrated pest management (IPM) and proactive measures to prevent contamination in crucial locations were recommended. The study proposed organic farming as a sustainable alternative, contributing to a healthy environment and human well-being.

Keywords: *Pesticide; Dimethoate; Ecotoxicology; Integrated pest management*

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INTRODUCTION:

Agriculture is the science and practice of cultivating the soil to grow crops and rear animals for food, wool, and other essential products. One of the primary challenges in agriculture is the presence of pests that can attack crops, leading to reduced yields (Tudi et al. 2021; Dhanaraju et al. 2022). Pests are defined as any animals or plants that have harmful effects on humans, their food supply, or living conditions. In simpler terms, pests can be described as destructive insects or other animals that damage crops, food, livestock, and more. Examples of pests include aphids, fruit flies, bollworms, whiteflies, leafhoppers, cutworms, beetles, and various other creatures (Skendžić et al. 2021; Ratnadass et al., 2012).

To manage and control these pests, pesticides are employed. Pesticides are substances designed for the purpose of preventing, destroying, or controlling pests and unwanted plant species that can harm or interfere with food production, processing, storage, transportation, or marketing (Pathak et al. 2022; Tudi et al. 2021). The term "pesticide" encompasses various categories, such as herbicides (used to control weeds), nematicides, molluscicides, piscicides, avicides, rodenticides, bactericides, insect repellents, animal repellents, antimicrobials, and fungicides. Among these, herbicides stand out as the most widely used, accounting for 80% of all pesticides (Park et al. 2021).

Pesticides are crucial in agriculture because they protect crops from pests, diseases, and weeds, which, if left unmanaged, could result in the loss of more than half of the world's crops. These chemicals play a vital role in enabling farmers to produce more food with less land, as they enhance productivity per hectare. In the world of pesticides, many substances can be grouped into chemical families. Notable insecticides include organochlorides, organophosphates, and carbamates (Jerry Cooper and Hans Dobson, 2007).

Pesticides are essential tools in modern agriculture and public health, designed to combat a wide range of organisms that can harm crops, livestock, or human well-being. These chemical formulations are created to target and manage pests, which can encompass insects, weeds, fungi, bacteria, and other undesirable organisms. Pesticides are critical in safeguarding agricultural yields, reducing crop loss, and ensuring food security by controlling pests that threaten the quality and quantity of harvests (Nicolopoulou et al. 2016).

Pesticides exist in various forms, including insecticides to tackle insect pests, herbicides to suppress weed growth, fungicides to combat fungal diseases, and bactericides to control harmful bacteria. They can be chemically synthesized or derived from natural sources. The use of pesticides has been instrumental in increasing agricultural productivity, helping to feed a growing global population (Mohamed and Ahmed, 2020; Ayilara et al. 2023; Abdollahdokht et al. 2022).

The utilization of pesticides is not without challenges and concerns. Their application may unintentionally harm non-target organisms, lead to environmental contamination, and contribute to the development of pesticide-resistant pests. Striking a balance between the benefits of pest control and minimizing potential risks is an ongoing priority in agriculture and public health. This requires a deep understanding of the different types of pesticides, their mechanisms of action, and their environmental impacts, with a focus on using them responsibly and effectively.

MATERIALS AND METHODS:

Study area

The research was conducted in the Tenkasi district of Tamil Nadu, focusing on specific regions including Shencottai, Sundarapandiyapuram, Sambavar Vadakarai, Panboli, Kadayam, and Surandaic. These areas were chosen due to the diverse range of vegetables and crops cultivated throughout the year. The selection of the study area was based on the types of crops grown and the extent of pesticide usage.

The crops cultivated in this region encompass a wide variety, such as potatoes, paddy, drumsticks, raw bananas, coconuts, carrots, onions, tomatoes, brinjal, okra, sunflowers, tapioca, and more. The farmers in these areas are actively engaged in large-scale crop and vegetable cultivation, which has led to a notable and variable increase in pesticide usage over time.
Pesticide use:

This section was used to obtain data about the types of pesticides used and sources of pesticides commonly used by the farmers.

RESULTS AND DISCUSSION:

The survey took place from November to March, during which the study site selection was tailored to the crops cultivated in the region. The study area comprised Shencottai, Sundarapandiyapuram, Sambavarvadakarai, Panboli, Kadayam, and Surandi in the Tenkasi district, where a diverse array of crops and vegetables were grown. The primary crops included sunflower, coconut, raw banana, paddy, and potato. The usage of pesticides varied depending on the cultivated crops, with notable pesticides such as neem oil, FAME, carbaryl, coragen, malathion, and dimethoate being employed more extensively based on the specific crops in cultivation. The observation leads to the conclusion that Dimethoate is the predominant pesticide used.

Pesticides and other contaminants entering the natural environment have the potential to impact wild plants and animals, a concern addressed by the field of ecotoxicology (Fleeger, 2020; Damalas and Eleftherohorinos, 2011; Tudi et al. 2022). This study specifically concentrates on the ecological effects of pesticides.

Pesticides can exert their influence over considerable distances from the application site. Those that bind to soil particles may be carried into streams through runoff, and pesticide drift can extend for many miles in the wind. Some pesticides exhibit persistent characteristics, lasting in the environment long after their initial application and posing risks to living organisms over an extended period (Plimmer, 1990). Notably, pesticides such as DDT and chlordane resist easy breakdown and linger in the application site, contributing to soil infertility.

Plants absorb pesticides through their roots and leaves, making them susceptible to the diverse impacts of these chemicals (Alengebawy et al. 2021; Bondareva and Fedorova, 2021). The effects of pesticides on individual plants and animals are varied and multifaceted, underlining the complexity of their ecological repercussions. The longevity of certain pesticides emphasizes the importance of understanding and mitigating their potential adverse effects on the environment.

Table 1: Impact of pesticide on the different insect pest in relation with seasons and crops

Name of the crop	**season**	**pest**	**pesticide**	**Chemical compound used**
Daucus carota Subsp.sativus (carrot)	July-February	Vegetable weaver/ aphids	linuron	400 g/litre linuron SC
Brassica oleracea var. capitata (cabbage)	October-November	Diamond back moth	FAME	Chlorantran Iliprate 18.5% SC
Phaseolus vulgaris (Beans)	July-February	Pod borer/beetle String bean insect	carbaryl	Carbaryl 43% (1-naphthyl methyl carbamate)
Oryza sativa (Paddy)	November-January	Spotted boll worm	FAME	Chlorantran Iliprate 18.5% SC
Manihot esculenta (Tapioca)	April-may	whitefly	NANMA	Neem oil as big formulation
Allium sepa (Onion)	April-July	Aphid	confidor	Imidacloprid 350 SC
Beta vulgaris (Beetroot)	July- august	Beet leafhopper/ Boll worm	PROFEX	Profenofos 40%+ cypermethirin 4%E.C
Solanum melongena (Brinjal)	June-September	Shoot and root borer/ jassids	carbaryl	Carbaryl 43% (1-naphthyl methyl carbamate)
Abelmoscus esculentus (Ladies finger)	June – August	Shoot and root borers/aphids/ flea/green stinkbugs	Roker	Profenofos and pyrethroid cypermethrin
Solanum lycopersicum (tomato)	March - June	Root- knot nematode	Abamectin	80% avermectin B_{1a} and 20% avermectin B_1
Raphanus sativus (Radish)	March-august	Aphids	Malathion	Dimethyl dithiophosporic acid and diethyl

				fumarate
Trichosanthes cucumerin (snake gourd)	January - march/ September - December	Fruit fly	Dimethoate or neem oil	Dimethoate 400E.C
Lagenaria siceraria (bottle guard)	January - march/ September- December	Squash bug/ whitefly	Neem oil or soap oil	Azadiractin and nimbin
Helianthus annus (sunflower)	January-June	Cutworms/ sunflower beetle	Soap or neem oil	Azadiractin and nimbin 46% nitrogen
Gossypium barbadense (cotton)	April -may/ December - January	Bollworm/ fruit worm	TRACK	Profenofos 40% and cypermethrin 4% E.C
Ipomoea batatas (sweet potato)	June - July	Potato tubeworms/ flea beetles	Pyrethrin	permethrin
Musa acuminate (raw banana)	February – April/ November- December	Banana weevil	chlorpyrifos	Chlorinated phosphates
Momordica charantia (bitter gourd)	January - march	Cucurbit fruit fly	Diptrex (trichlorfon)	500 g/l trichlorfon
Luffa (ridge gourd)	January - April	Leaf miner/fruit fly	malathion	Dimethyl dithiophosporic acid and diethyl fumarate
Triticum aestivium (wheat)	October – December/ February - may	Aphid	Organo chlorides	Chlorines include DDT
Zea mays (maize)	June - July	Stem borer/ shoot fly	glyphosate	Isopropylamine salt
Solanum tuberosum (potato)	October – November	Black and yellow striped potato bud	coragen	Chlorano traniliprole S.C
piper betle (betel)	January - february	Red spider mite/ Aphids/shoot bugs/white fly	fizimite	permethri
Moringa olifera (drumstick)	May - june	Bud worm/ hairy caterpillar	dimethoate	Dimethoate 400E.C
Mangifera indica (mango)	February- march	Mango hopper/fruit fly/stem borer	Dimethoate	Dimethoate 400E.C
Cocus nucifera (coconut)	April	Red palm weevil	Imidacloprid	chloronicotinyl
Coccinia grandis (ivy gourd)	February - march	Aphids/ whitefly	Garlon 4	Triclopyr D
Dioscorea alata (elephant foot yam)	April - may	mealybugs	Cow dung slurry with neem cake oil	Azadirachtin and animal waste
Pisum sativum (pea)	February - march/ October – november	Aphids / pea weevil	neonicotinoid	Acetamaprid and thiamethoxam
Spinacia oleracea (spinach)	March- may	Cutworms/ caterpillars	Dimethoate	Dimethoate 400E.C

CONCLUSION:

When deciding whether to use pesticides, it's essential to balance the potential benefits against the associated costs, considering environmental impacts. Despite adhering to a pesticide's label instructions, there is a possibility of causing harm. In such cases, users must carefully weigh the costs and benefits, and if necessary, opt not to use the product.

For those choosing to use pesticides, it is crucial to read and follow the label instructions precisely. While this reduces the risk, it does not guarantee the prevention of accidents. Careful consideration of the environmental hazards section is necessary to assess potential harm to living organisms. If there is a risk, opting for an alternative product is advisable, preferably choosing the least toxic option that effectively addresses the issue. Integrated pest management (IPM) offers a viable alternative, potentially requiring fewer or no pesticides.

Knowing your application area well is key. If specific spots are crucial for unique plants or wildlife, proactive measures should be taken to prevent contamination, especially during critical times of the year. Instead of resorting to pesticides, organic farming stands out as an optimal approach for maintaining a healthy environment. Abstaining from pesticides contributes to soil fertility preservation and serves as a preventive measure for human health.

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