Int.J.Curr.Res.Aca.Rev.2021; 9(11): 83-93

International Journal of Current Research and Academic Review

ISSN: 2347-3215 (Online) Volume 9 Number 11 (November-2021)

Journal homepage: http://www.ijcrar.com

doi: https://doi.org/10.20546/ijcrar.2021.911.010

Review of Pesticide Use in Vegetable Farms and its Consequences in Ethiopia's Central Rift Valley

Midekesa Chala*

Ethiopian Institute of Agricultural Research, Ambo Agricultural Research Center, P.O.Box, 37, Ambo, Ethiopia

**Corresponding author*

Abstract

Pesticide use is popular in vegetable agriculture to manage pests and pathogens, but it often comes at the expense of the environment and human health. This review study intends to contribute to a better knowledge of the influence of pesticides on the environment and humans by providing an overview of major pesticide abuse in the rift valley of Ethiopia, as well as new scientific discoveries on pesticide use and dangers. Farmers in the study areas are overusing, misusing, and abusing pesticides by indiscriminately applying pesticides in violation of scientific recommendations, storing them in an unsafe manner, and ignoring risks, safety instructions, and protective devices when applying pesticides and discarding containers. Pesticides present a number of risks, including direct effects on humans, indirect effects on food commodities, environmental impacts, surface and ground contamination, soil contamination, effect on soil fertility (beneficial soil microorganism), contamination of air, soil, non-target vegetation, and non-target organisms. Reviewing pesticide use and its impact is important for agricultural progress. The government can help by enforcing pesticide regulations, preventing illegal pesticide trade, and raising awareness about how to use pesticides safely without harming the environment or individuals.

Article Info

Accepted: 15 October 2021
Available Online: 20 November 2021

Keywords

contamination, Misuse of pesticide, Regulation, Hazard.

Introduction

Ethiopia's Central Rift Valley (CRV) region is one of the country's early adopters of market-oriented irrigated vegetable crop cultivation. Although vegetable production in this area has risen in recent years, with most growers using hybrid seeds and significant agricultural inputs, small-scale farmers still face a number of obstacles, including pest challenges. Under rain-fed and irrigated conditions, these farmers grew tomato, onion, green pepper, cabbage, and potato throughout the year. Farmers rely significantly on insecticides because they have a low tolerance for pest infestation. Furthermore, government extension programs promote pesticide use, claiming that farmers have no other option (Mengistie *et al.,* 2014; Damte and Tabor 2015). Mancozeb, Selecron, Redomil, Malathion, Karate, Thionex, and Profit were the most regularly used pesticides in CRV, according to Mengistie *et al.,* (2015). During one agricultural season, the majority of farmers reported using more than four different pesticides. Smallholder farmers' pesticide use patterns are more complicated than large-scale farmers' since they are typically resource-poor and risk-averse. Furthermore, smallholder farmers are more exposed to pesticides and use hazardous application procedures, putting their

health at risk than larger-scale farmers (Ngowi *et al.*, 2007; Williamson *et al.*, 2008).

Crop protection products have increased land productivity, reduced the need to farm additional land, and helped farmers earn more money in a more consistent manner (Damalas, 2009). Pesticides defend crops against dangerous pests and diseases, allowing farmers to ensure food security while conserving natural resources. Pesticides, especially hazardous chemicals, are used by farmers to a larger extent than traditional pest control approaches (such as physical and mechanical control) and integrated pest management (IPM). Pesticide use has risen in recent years due to their simplicity of use and high efficacy (Carvalho, 2017). However, pesticide misuse can occur, particularly in underdeveloped nations, posing serious health and environmental risks (Mengistie *et al.*, 2017). Pesticide usage has a negative impact on the ecosystem, resulting in ecological imbalance and pollution. Furthermore, farmers' over-reliance on pesticides, a lack of knowledge of adequate pesticide handling methods, and limited access to pesticide training all point to a significant risk of pesticide exposure for farmers and pesticide residues on crops (Damalas *et al.*, 2017). Most CRF farmers do not obtain appropriate technical advice or knowledge on pesticide application from formal extension programs, and farmers spray pesticides on perishable vegetables without evidence of pest or disease by combining two or more pesticides. Pesticide usage, illegal dealing, and other issues are exacerbated by the lack of pesticide inspectors at the regional, zonal, and district levels. Unauthorized and untrained people sell pesticides in village markets and in a variety of other non-designated locations. The largest users of pesticides in Ethiopia are smallholder vegetable farmers in the Ziway and Meki regions, who are poor resources and purchase pesticides from open marketplaces since pesticides are available at lower prices than in retailer shops.

The critical problem of pesticide exposure among farmers necessitates prompt intervention targeted at raising awareness about alternative pest control methods that utilize fewer chemicals (Baharuddin *et al.*, 2011). Because pesticides are readily available and extremely effective, all vegetable producers use them as the primary means of controlling their insect issues. Other crop protection techniques, such as integrated pest management (IPM) and biological control, are not widely used or understood by farmers. The purpose of this study is to contribute to a better knowledge of the influence of pesticides on the environment and human beings by providing a review of major pesticide misuse in the rift valley of Ethiopia, as well as new scientific results on pesticide use and risks.

General objective

The objective of this review paper is to review Pesticide use in vegetable Farms and its impact in the case of the central rift valley of Ethiopia.

Specific objectives

To review the Benefit of pesticides in vegetable production in Ethiopia

To review the pesticide supply chain and Costs in Ethiopia

To review Hazards of pesticides in Rift valley Ethiopia and to recommend strategies for management of chemicals

Materials and Methods

Information was acquired through secondary sources such as the internet, books, articles, proceedings, literature, cross-referencing, and publications such as the International Journal of Agricultural Sustainability, Journal of Plant Protection, Horticulture, and other related science. Because the title refers to Ethiopia's current situation, the majority of the information is gleaned from the internet and other recently released journals and books. A large number of studies were found and reviewed. The risk of pesticide misuse in vegetable production under Ethiopian conditions was discussed and concluded attractively and scientifically using secondary data sources, ultimately recommending strategies for sustainable vegetable production intervention to Pesticide use in vegetable Farms and its impact in the case of Ethiopia's central rift valley. A crucial factor for selecting secondary data sources was the idea content of published materials, who did what, and who wrote what about this issue.

Review of works

Pesticide use in the central rift valley of Ethiopia

A detailed analysis of agricultural technologies and the development of appropriate practices are required to promote agricultural production sustainability. Pesticides are agricultural instruments that assist farmers in

controlling pests and weeds, and they are an important part of crop production (Jansen and Dubois, 2014). As a result of recent agricultural expansion, pesticide use has surged in Ethiopia. Pesticides are utilized to manage pest problems by practically all commercial vegetable farmers in the central rift valley because they are easily available, easy to use, labor-intensive, and very effective. Farmers are unfamiliar with other crop protection measures.

In Ethiopia's Central Rift Valley, pesticides are becoming more readily available, and farmers have easy access to them. However, there is no reliable data on how many pesticides are used in Ethiopian vegetable growing (Mengistie *et al.,* 2015). In Ethiopia's Rift Valley, pesticide use by smallholder and commercial farmers is frequent. During the 2013/14 crop seasons, 13,889 smallholder vegetable growers sprayed 53,044 l of pesticide and 50,957 kg of fungicide, according to a survey performed by the Irrigation Development Authority Office of Ziway and Meki districts in the Central Rift Valley (CRV).

Pesticide police and Registration system in Ethiopia

To encourage pesticide governance that protects the environment and human health, Ethiopia has devised a legal framework for pesticide registration and regulation. In Ethiopia, the first Pesticide Registration and Control Special Decree No. 20/1990 was enacted in 1990 to govern pesticide imports, sales, distribution, and use. Pesticide registration began six years after the directive was adopted, in 1996. Pesticides are nevertheless registered, traded, and used inappropriately in Ethiopia, demonstrating that there are significant gaps between pesticide policy on paper and its implementation in practice. Between 1996 and 2011, 274 pesticides were registered, the majority of which were insecticides (PHRD, 2015). Agrochemical registration in Ethiopia entails a single efficacy trial and a quick first-tier assessment of the pesticide's properties, such as basic physicochemical properties and WHO classification status, which are obtained from databases such as the WHO risk classification, the EPA classification of active ingredients, or the European Pesticides Properties Database by the registrant (PPDB). According to a WHO classification analysis, 133 (58%) of the 231 pesticides reviewed for registration fell into the low-risk category, whereas 16 (7%) fell into the severely dangerous groups Ia and Ib (table 1). Pesticides are utilized extensively in Ethiopian agriculture. In many parts of Ethiopia, incorrect pesticide distribution and use have become increasingly serious as a result of this process, posing serious environmental and human health dangers. This is especially true in vegetable-growing areas, such as CRF, where basic pesticide-use standards are frequently neglected. Ethiopia has implemented pesticide registration and control processes, which are regulations and directives in which the country also includes many international agreements relating to pesticides, in order to protect human health and the environment. As a result, overall pesticide registration, distribution, and use regulation plays a critical role in enhancing the environment, the health of growers, and the surrounding community, as well as stimulating the Ethiopian agricultural sector's economic performance. However, there was a lack of effective and long-term application of pesticide registration, distribution, and use policy in CRF.

In terms of distribution and use, the absence of enforcement of pesticide policies has led to improper pesticide trafficking and use in CRF. In terms of distribution and use, the absence of enforcement of pesticide policies has led to improper pesticide trafficking and use in CRF. Pesticides are (still) monitored with far less vigor, and the regulatory authority has no information about products once they have been registered. While some importers adhere to the policy's standards, most retailers fail to register and sell their items in accordance with national pesticide legislation. The powers of pesticide inspectors, for example, are clearly stated in article 30 (1) of the pesticide policy, which gives them the authority to conduct periodic inspections of import, pack, repack, label, store, sale, distribution, or use during working hours, without a warrant, and upon presentation of his/her identity card, to carry out all responsibilities. However, my observations reveal that there is no effective enforcement to limit illicit retailing, and state pesticide inspectors are not carrying out their duties in accordance with the proclamation's authority.

Benefit of pesticide in vegetable production

Small-scale farmers practicing subsistence farming, which is dominated by cheap inputs and low-technology farming practices, used to dominate Ethiopian agriculture. This was thought to be the primary cause of farmers' low output and productivity; as a result, the government is pushing the use of agrochemicals across the country in order to boost output and productivity (CSA, 2012). One of the driving causes behind the Green Revolution was Argo-pesticide technology. Significant

yield enhancements were attained when high-yielding crop varieties and more land for crop cultivation were combined. Pesticides have played an important role in ensuring food security during the last five decades by helping to boost agricultural production and control disease vectors (Matthews, 2006).Their main advantages include boosting crop yields or productivity by preserving crops from diseases, pests, and weeds, reducing crop product deterioration in storage, and extending the shelf-life of fruits and vegetables to keep marketability (Aktar *et al.*, 2009). Pesticides, when used wisely and only when necessary, can help enhance productivity and allow us to feed and protect an ever-increasing human population (Matthews, 2006). Pesticides have recently been strengthened by the introduction of various different chemical groups, giving crop growers a number of options for greater pest control on the one hand while limiting negative effects on the other (Taylor *et al.*, 2007). According to Amera, T., and Abate, A.'s (2008) assessment of pesticide benefits in the central rift valley, 84.4 percent of respondents said pesticides cured their insect problems, and 80.6 percent said pesticide use enhanced crop yield.

Pesticide use by vegetable farmers in Central Rift Valley

Pesticide exposure is reduced by using appropriate and well-maintained spraying equipment and following all necessary measures at all phases of pesticide handling. Overall optimization of pesticide handling in accordance with rules, as well as consideration of public concerns about pesticide residues in food and drinking water, could help reduce pesticide-related harm to human health and the environment. All of this may appear complicated, but it appears to be a practical strategy to ensure an adequate supply of safe food within a viable agricultural production system (Kalayou Hiluf and Amare Ayalew, 2015). Diseases and pests, according to Dinham (2004), are some of the most serious difficulties that vegetable growers in Ethiopia face. Vegetables are extremely vulnerable to a variety of pests and diseases, necessitating careful pest management.

Pesticides are used by Ethiopian smallholder vegetable producers, but they aren't well informed about the risks. Pesticide misuse by smallholder farmers is common, resulting in acute poisoning and health problems such as headaches, vomiting, skin irritation, and eye irritation, as well as excessive pesticide residual levels in food and drinking water (Mekonnen and Agonafir, 2002; Ahrne, 2004). Pesticides' influence on human health and the environment has recently become a serious worry in Ethiopia as a result of rapid agricultural development (Teklu *et al.*, 2015). However, for pest management on vegetables, smallholder vegetable farmers in CRF use a variety of hazardous pesticides and fungicides (table 2 and 3). As shown in tables 2 and 3, many pesticides and fungicides used in Ethiopia's CRF are extremely toxic or moderately harmful. Endosulfan, for example, is an extremely dangerous insecticide used to control the ball warm pest of tomato and onion. Furthermore, Mancozeb is the most extensively used fungicide by vegetable growers in Ethiopia's CRV for tomato and onion disease control, posing significant environmental and organismal risks.

According to Amera, T., and Abate, A. (2008), 94.3 percent of farmers in the Rift Valley use pesticides as part of their agriculture input, and 28.7% of farmers use DDT for agriculture. Protective equipment was practically never used in the area, and 31% of respondents said they became sick after spraying pesticides, and 14.2% said they had a health-related pesticide event in their family. Farmers received relatively little instruction on pesticide risks, resulting in a poor level of awareness. Roughly half of the respondents said they utilized empty pesticide containers to store water or food, and about 7% said they sell empty pesticide containers to others. About 31% of the respondents saved insecticides anywhere inside the house and approximately 6% of them saved pesticides even within the kitchen.

Pesticide supply chain and Costs of pesticide in Ethiopia

The majority of pesticides used in Ethiopia are imported by multinational businesses through local agents (registrants) (Mengistie *et al.*, 2015). Pesticide governance is commonly seen as a major concern in terms of ensuring environmental safety and long-term pesticide distribution and use. According to a survey conducted by Mengistie (2016), several unregistered pesticide merchants were found in Ziway, Meki, and Addis Ababa. The point of sale is ineffectively monitored due to a significant number of unlicensed sellers, leading in the acquisition of unregistered pesticides, substandard pesticides, and expired pesticides.

Different ministries, departments, and bureaucracies in Ethiopia are in charge of various areas of chemical management (pesticides). In terms of pesticide

management, the federal and local governments' ministries of agriculture, Ethiopian Agricultural Research Institute, Environmental Protection Authority, Ministry of Health, Ministry of Labor and Social Affairs, Ministry of Trade and Industry, Custom Authority, Standards & Quality Control Agency, and others operate at a very low capacity. Pesticide usage, illegal dealing, and other issues are exacerbated by the lack of pesticide inspectors at the regional, zonal, and district levels. Unauthorized and untrained people sell pesticides in village markets and in a variety of other non-designated locations. Pesticides available on open marketplaces in Meki and Zuway play a larger role in the sale of pesticides at lower prices than those available in retailer's shops (Mengistie, 2016). As a result, smallholder farmers are at risk because they refuse to receive pesticide training, support, or information. Indeed, it was a state government failure that prompted importers and retailers to aggressively sell and distribute pesticides in a dangerous manner, impeding the spread of a private style of governance.

Pesticides are frequently thought of as a quick, easy, and low-cost way to control weeds and insect pests in vegetable production. Pesticide use, on the other hand, comes at a hefty expense. The expense of creating new insecticides is escalating at an alarming rate. Government regulations and stricter licensing criteria have also hindered development and raised the expense of new items. Companies have been hesitant to introduce new products due to concerns about product liability. Because of the growing problem of insect resistance, many pesticides now have shorter shelf lives than in the past. Chemical businesses will face increased costs and maybe decreased earnings as a result of all of these reasons. As a result, pesticide users will face increased prices. One of the purposes of Integrated Pest Management is to keep agriculture economically viable. According to the results of a survey conducted by (Mengistie *et al.,* 2015), pesticides are the most expensive input in tomato and onion production when compared to other inputs such as fertilizers, manpower, water pumps, or seeds. Concerns regarding toxicity, residue effects, environmental implications, or risk/benefit ratios for themselves or their customers were not major factors in pesticide selection. Farmers also acquired less expensive but broad-spectrum (and consequently harmful) pesticides (e.g., DDT), which are effective against a wide range of pests. Pesticide merchants, particularly shopkeepers, also sell unregistered, unlabeled, or repackaged pesticides on the open market in CRF cities such as Zuway, Meki, Adami Tulu, Koka, and others, in violation of the law and regulation, necessitating more stringent surveillance.

Pesticides are also sprayed on perishable vegetables in CRF, despite the absence of evident signs or symptoms of pest/disease presence. According to plant protection experts, mixing two or more pesticide products (fungicides with insecticides) was a common practice in the Ziway and Meki districts. The high cost of pesticides is the most common restraint (53 percent of farmers), leading them to employ low-quality pesticides (potentially contributing to resistance). Pesticide efficacy is a problem that 48 percent of farmers face (Table 2). A high number of farmers may have purchased pesticides from unregistered vendors, indicating that there are quality issues in the pesticide distribution network.

Farmers rely very little on information and recommendations from extension agents, confirming the limited role of government agencies in the management of pesticides in Ethiopia (Mengistie *et al.,* 2014). The total cost-benefit picture of pesticide use is markedly different between developed and developing countries. The economic impact of pesticides on non-target species (including humans) has been estimated at approximately $8 billion per year in developing countries. It is essential to weigh all the risks against the benefits to ensure maximum safety. For developing countries, it is imperative to use pesticides, as no one likes famine and infectious diseases like malaria (Actar *et al.,* 2009).

Hazards of pesticide in Rift valley Ethiopia

The current large agricultural transition in Africa is expanding anthropogenic pollution sources, which is becoming a serious environmental concern (Pretty *et al.*, 2011). The changes in Ethiopia's Central Rift Valley (CRV), where smallholder horticultural farmers and large-scale flower-growing corporations are clustered around Lake Ziway, are one such example. Farmers in the CRV typically use larger pesticide dosages than recommended, on the mistaken belief that a bigger dose equals better pest eradication. Because unlabeled units (such as tins) and varied pesticide mixtures were utilized, determining the exact overdosing proved challenging. Using insecticides alone to control pests has revealed a number of issues and limitations. Pesticide resistance; higher costs; toxicity to fish, animals, beneficial natural enemies of pests, and other non-target creatures; human health and safety concerns; groundwater contamination; and overall environmental quality are just a few of the issues. According to a 2015 survey by Mengistie *et al.*,

farmers in the rift valley use pesticides on vegetables in violation of their recommendations, including using unsafe storage facilities, ignoring risks and safety instructions, not using protective devices when applying pesticides, and disposing of containers in an unsafe manner. According to Mengistie *et al.,* (2015), the most popular means of disposing of empty pesticide containers in the central rift valley was to throw them in the field (97 percent), irrigation canals, or rivers (82 percent). They were also buried, burned, reused for water or food storage, and sold as an alternative. Pesticide containers were also mounted on sticks to keep birds away from the crop. The majority of these pesticide packaging disposal methods pose considerable environmental and health hazards, as approximately 2% of pesticides remain in the empty packaging (Briassoulis *et al.,* 2014). In CRV Ethiopia, vegetable growers clearly demonstrate improper pesticide use in their planting practices. In defiance of the recommendations, farmers use pesticides indiscriminately. Pesticide use techniques have ramifications for agricultural sustainability, grower and consumer health, and the environment. This circumstance necessitates a change in these behaviors. According to a study by Mengistie *et al.,* (2015), vegetable farmers in Ethiopia's CRV overuse, misuse, and abuse pesticides by applying pesticides indiscriminately, storing them unsafely, and ignoring risks, safety instructions, and protective devices when applying pesticides and disposing of containers. When the worst infestation occurs, some tomato producers in CRF blend insecticides and fungicides and spray as many as 17 times in a rainy season and eight times in a dry season, whereas a maximum of five is suggested. Farmers cite three causes for present (high) pesticide use: low pesticide performance relative to standards, pressure from retailers and their scientific recommendations, and high disease/pest incidence. Insecticides including Malathion, endosulfan, deltamethrin, profenofos, diazinon, and lambdaculalothrin, as well as herbicides like glyphosate and pyroxsulam, are among the most harmful pesticides used by small-scale farmers in Ethiopia's central rift valley (Table 3).

Direct impact on human and Environment

As agriculture becomes more intense, more hazardous organic and inorganic substances are released into the environment. Pesticides are among the most dangerous compounds in the environment because of their extensive usage, stability, selective toxicity, and bioaccumulation. They're especially harmful in fruits and vegetables, where they're consumed by people (Fenik *et al.,* 2011). Almost all farmers, according to Mengistie *et al.,* (2015), lacked substantial knowledge of the environmental and health implications of pesticide use. Despite the fact that 76 percent of farmers believe pesticides harm human health, the majority also believe pesticides do not harm animal health (75 percent) or water bodies (91 percent).Farmers in Ethiopia do not understand the environmental implications of pesticides, according to Jansen and Harmsen (2011) and Teklu *et al.,* (2015). Pesticide use has sparked growing public concern about probable negative consequences on human health, animals, groundwater, and general environmental quality.

The general population is concerned about pesticide exposure via drift to non-target areas, contamination of ground and surface waters, and residues on food. Applicators should be particularly worried because they may be exposed to the greatest amount of radiation and so face the biggest health hazards. All applicators must be aware of public concerns regarding pesticide use and only use ingredients in a safe and responsible manner.

Pesticide exposure is reduced by using appropriate and well-maintained spraying equipment and following all necessary measures at all phases of pesticide handling. Overall optimization of pesticide handling in accordance with rules, as well as consideration of public concerns about pesticide residues in food and drinking water, could help reduce pesticide-related harm to human health and the environment. All of this may appear complicated, but it appears to be a practical strategy to ensure an adequate supply of safe food within a viable agricultural production system (Kalayou Hiluf and Amare Ayalew, 2015).

Pesticides have infiltrated nearly every aspect of our ecosystem. The quantity and quality of surface water resources in the Central Rift Valley are under jeopardy as land and water resources are being exploited. Smallholder irrigated agriculture (mainly horticulture) has grown significantly, while large-scale, export-oriented industries have sprung up around Lake Ziway.

Table.1 Risk categories of registered pesticides in Ethiopia based on WHO classes

WHO Toxicity class	**Pesticides (Number)**	**Percent**
Extremely hazardous (class Ia&Ib	**16**	**7%**
very Hazardous (class II)	**42**	**18%**
Moderately hazardous (class III)	**133**	**58%**
Unlikely to present acute hazardous (class U)	**40**	**17%**

Source: Assefa 2010

Table.2 Insecticides used by vegetable farmers in the CRV of Ethiopia, 2013/14 crop seasons

Trade name	**Type of crop**	**Type of pest and disease**	**WHO's toxic class**
Selecron 720%EC	**Onion**	**Thrips, (broad spectrum)**	**II**
Karate 2.5% EC	**Tomato, cabbage**	**Thrips, Sucking Insects/wide range of insects**	**II**
Profit 720EC	**Tomato, cabbage**	**Onion thrips, leafhoppers**	**II**
Ethiolathion 50EC	**Tomato, onion, cabbage**	**Any worms**	**II**
Ethiozinon 60EC	**Tomato, pepper**	**Boll worm, termite**	**II**
Ethiodemethrin 2.5EC	**Onion**	**Thrips**	**II**
Ethiothoate 40%EC	**Tomato**	**White flies, spider mites**	**II**
Radiant 120SC	**Tomato, onion**	**Onion Thrips, Tutaabsoluta on, broad spectrum**	**II**
Coragen 200 SC	**Tomato**	**African ball worm, Tutaabsoluta**	**III**
Tracer 480SC	**Tomato**	**Boll worm, Tutaabsoluta**	**IV**
Helerat 50EC	**Onion**	**Thrips ,ball worm**	**II**
Dimeto40%EC	**Tomato, cabbage**	**Ball worm and cabbage Aphids**	**II**
Lamdex 5% EC	**Onion, cabbage**	**Ball worm, Aphids**	**II**
Decis 2.5%EC	**Cabbage**	**Ball worm, aphid, fruit-borer**	**II**
Ethiosulfan	**Tomato, onion**	**Ball worm**	**Ib**
Dursban 48%EC	**Tomato, onion, cabbage,**	**Stalk borer, termites, soil born insects**	**II**
Fastac10EC	**Tomato**	**Ball worm, thrips & whitefly.**	**III**

Source: Mengistie *et al.*, 2014

Table.3 Fungicides used by vegetable farmers in the CRV of Ethiopia, 2013/14 crop seasons

	Type of crop	Type of pest and disease	WHO's
Mancolaxyl 72WP	Tomato	Late blight, powdery mildew	II
Agrolaxyl M2-63.5 wp	Tomato	Late blight, leafspot	II
Victory 72WP	Tomato	Late blight	II
Masco® 8-64	Onion, cabbage	Downey mildew, Late blight	II
Ridomil 68WG	Onion, tomato	Purple blotch, Late blight, and downy mildew	III
Unizeb (Mancozeb 80%WP)	Onion	Thrips	II
Indom (Mancozeb 80%WP)	Tomato	Late blight, leaf spot	II
Fungozeb (Mancozeb 80%WP)	Tomato	Fungus	II
Indofil M-45 (Mancozeb 80%WP)	Tomato	Fungus	II
Ethiozeb(Mancozeb 80WP)	Tomato	Late blight.	II
Cruzate R	Cabbage, Onion	Purple blotch, downy mildew and late blight	III
Bayleton 25 WP	Tomato	Powdery mildew, late blight	III
Matco 8-64	Tomato, onion, cabbage	Late blight, Downy mildew.	II
Kocide 101	Tomato, onion, cabbage	Early and late blight	III
Revus 250SC	Tomato, onion	Late blight, Downy Mildew	III
Natura 250 EW	Tomato, onion	Early blight, purple blotch	II
Nimrod 25 EC	Pepper, tomato	Powdery mildew	III

Source: Mengistie *et al.*, 2014

Table.4 Difficulties faced in using pesticide in CRF (n=65)

Items	Percentage
High price	**53**
Low quality (resistance)	**48**
Lack of safety device	**9**
Unavailability when it is needed	**0**

Source:Mengistie, B., 2016

Table.5 World Health Organization (WHO) Toxicity/hazard classification

WHO Toxicity class	Percentage
Extremely hazardous (class Ia&Ib	**5.7**
Moderately Hazardous (class II)	**48.5**
Slightly hazardous (class III)	**15.3**
Unlikely to present acute hazardous (class U)	**14.5**

Source: PRRP-Ethiopia, 2013

The rising usage of pesticides, as well as the effects of pesticide residues on the aquatic environment and human health, are two major concerns (Jansen H. C. and J. Harmsen, 2011). Preventive strategies aimed at minimizing or improving pesticide application, as well as mitigating measures aimed at reducing the impacts of emissions, can help to mitigate the environmental and health effects of pesticide use.

Surface and Groundwater contamination

Pesticide residues have been identified in soil, air, surface, and groundwater across the globe, and urban pesticide use is a contributing factor. According to a survey conducted by the Pesticide Action Network-United Kingdom (PAN-UK) on pesticide use and management by small-scale farmers in Ethiopia's Central

Rift Valley, 97 percent of respondents said they used pesticides once or twice a year, and 91 percent prepared pesticides near water sources used by local people for drinking, cooking, and other household purposes, while 61 percent washed their pesticide sprayers and other equipment (PAN-UK, 2006). According to the same survey, 74 percent of farmers mixed their pesticides near a river, 96 percent were unaware that pesticides can harm water bodies, and 88 percent said their pesticide use had increased in the previous five years (Mengistie *et al.*, 2016).

Pesticide monitoring conducted by Jansen H. C. and J. Harmsen in 2009 and 2010 showed that most surface water samples taken from agricultural areas north of Lake Ziway and between Meki and Ziway town contain pesticide residues. Pesticide concentrations occasionally surpass 0.1 g/l, which is the European and Dutch drinking water threshold. According to Jansen H. C. and J. Harmsen (2011), a total of 30 different pesticides were discovered in the effluent waters of the Ziway floriculture firms at concentrations of 0.1 g/l or higher. Fenitrothion (0.16 g/l), iprovalicarb (0.01-0.38 g/l), methomyl (0.26-2.7 g/l), triadimefon (0.16 g/l), and triforine (0.1-0.4 g/l) are the five pesticides categorized as high-risk pesticides. Improper pesticide application, such as inappropriate pesticide selection, abuse of pesticides on agricultural commodities, or harvesting crops before residues have washed off, can result in a large number of residues on products that people eat (Chen *et al.*, 2011). Because of bioaccumulation, inhalation, or skin contact, humans can be exposed to pesticides through the eating of contaminated foods, drinking water, and animal products (Bakirci *et al.*, 2014).

Toxicity to Natural Enemies and Other Non-target Organisms

Natural enemies of insect species can be quite beneficial in reducing pest populations. Beneficial creatures include those that are predators, parasites, or rivals to the pest species' harm. Aphids, for example, do not reach pest proportions every year because they are kept in control by a variety of natural enemies. Unfortunately, many broad-spectrum, non-selective pesticides harm many beneficial species more than they harm pests. The use of such pesticides frequently results in a rebound of insect populations, which occurs at a far faster rate than natural enemies. Primary (existing) and secondary (new) pests are typically allowed to reach destructive levels at a faster rate when natural controls are absent. An increase in insect populations usually necessitates more chemical treatments, which suppresses or destroys natural enemies and stimulates the development of pest resistance.

Pesticide pollution poses serious threats to the environment and non-target creatures, including beneficial soil microbes, insects, plants, fish, and birds (Actar *et al.*, 2009). According to a study conducted by Yohannis *et al.*, (2014) on organochlorine pesticides (OCPs) in edible fish species from Lake Ziway in the Ethiopian Rift Valley, dichlorodiphenyltrichloroethanes (DDTs) and hexachlorocyclohexanes (HCHs) were the most prevalent contaminants that pose a risk to human health. Because of the area's closeness to vast and different aquatic and terrestrial ecosystems, the Rift valley has been home to about half of Ethiopia's bird species. The number of nesting birds has shrunk to a few hundred couples today (Hengsdijk, H. and Jansen, H., 2006).

Pesticide Resistance

Because pesticides are administered more frequently and at higher dosage rates in an attempt to achieve better or total insect control, resistance issues have grown. Selection pressure has intensified as a result of these techniques. Pesticide treatments can be survived by naturally resistant individuals in a pest population. The survivors reproduce and transmit the resistance gene on to their children. In comparison to previous generations, the pest population grows more difficult to manage with the same chemicals with each passing generation. Pest resistance can be reduced by reducing pesticide use and cycling between classes of pesticides with distinct mechanisms of action. Pest resistance management is critical for extending the useful life of essential insecticides.

The frequent extermination of beneficial insects interferes with natural pest control, which can lead to new pest concerns (Damalas *et al.*, 2011). This means that tiny pests, which are normally held in check by their natural enemies, could spread quickly in the absence of such enemies, causing outbreaks. In this situation, pest management for one pest may result in an outbreak of a different pest. Another issue with indiscriminate pesticide usage is the potential for pests to develop resistance to the chemicals. Farmers typically chose to spray more frequently and use higher pesticide doses when they don't have any guidance on how to cope with this problem. This only adds to the difficulties, such as greater chemical exposure and an increased risk of

pesticide resistance. Furthermore, pesticides sprayed on crops might leave residues that can be ingested by consumers, with varying levels of exposure among populations in different parts of the world (Goen *et al.*, 2017).

Vegetable production in Ethiopia has increased dramatically in recent years, primarily in the northern and central rift valley (CRF) areas, as national agricultural strategies began to prioritize high-value cash crops. Vegetables, on the other hand, are extremely prone to a wide range of pests and diseases, necessitating comprehensive pest management. In vegetable cultivation, pesticides are frequently regarded a quick, easy, and low-cost approach for controlling diseases, weeds, and insect pests. Both the types and volumes of pesticides used in Ethiopia are thought to be expanding at an alarming rate. Many pesticide risk reduction projects have been implemented in CRF Ethiopia, however small-scale farmers in Ethiopia continue to use pesticides in ways that are contrary to recommendations. Pesticide misuse, illegal selling, and other issues are exacerbated by a lack of proper technical help and information on pesticide use from official extension services, as well as the absence of pesticide inspectors at the regional, zonal, and district levels. Unauthorized and untrained people sell pesticides in village markets and in a variety of other non-designated locations. In addition, policy on pesticide registration, distribution, and use was poorly implemented in CRF.

Pesticides are overused, misused, and abused by vegetable farmers in Ethiopia's CRV, who apply pesticides indiscriminately in violation of scientific recommendations, store them improperly, and disregard risks, safety instructions, and protective devices when applying pesticides and discarding containers. Pesticide merchants, particularly shopkeepers, also sell unregistered, unlabeled, or repackaged pesticides on the open market in CRF cities such as Zuway, Meki, Adami Tulu, Koka, and others, in violation of the law and regulation, necessitating more stringent surveillance.

Pesticides have poisoned practically every aspect of the environment in the central rift valley. Pesticides pose a number of risks, including direct effects on humans, indirect effects on food commodities, environmental effects, surface and ground contamination, soil contamination, effect on soil fertility (beneficial soil microorganism), contamination of air, soil, non-target vegetation, and non-target organisms. In Ethiopia, many ministries, departments, and bureaus are responsible for various areas of chemical (pesticide) management; nevertheless, they operate at a very low level of cooperation and capacity in terms of pesticide management.

Suggestions for future

The government should play a significant role in sustaining agricultural growth by enforcing pesticide use regulations, preventing illegal pesticide trade, and raising awareness about how to use pesticides appropriately without harming the environment or persons.

For pesticide control, it is vital to increase the collaboration of relevant state and non-state entities.

Researchers, politicians, and donors must pay more attention to external costs and implement a variety of policies and programs to reduce the use of dangerous pesticides and replace them with safer alternatives.

To address the problem of illicit importing, trading, small-scale pesticide usage, and commercial vegetable production, the government should establish pesticide inspectors at the regional, zonal, and district levels.

Upgrading and motivating state actors (experts) at all levels to provide pesticide information and technical knowledge to farmers.

References

Akhtar, W., Sengupta, D., and Chowdhury, A., 2009. Impact of pesticides use in agriculture: their benefits and hazards. Interdisciplinary Toxicology, 2(1), pp.1-12.

Amera, T. and Abate, A., 2008. *An assessment of pesticide use, practice, and hazards in the Ethiopian Rift Valley*. Institute for Sustainable Development, Ethiopia.

Bakırcı, G. T., Acay, D. B. Y., Bakırcı, F., and Otleş, S., 2014. Pesticide residues in fruits and vegetables from the Aegean region, Turkey. *Food Chemistry*, *160*, pp.379-392.

Baharuddin, M. R. B.; Sahid, I. B.; Noor, M. A.; Sulaiman, N.; Othman, F, 2011. Pesticide risk assessment: A study on inhalation and dermal exposure to 2,4-D and paraquat among Malaysian paddy farmers. J. Environ. Sci. Health Part B 46, 600–60

Briassoulis, D., Hiskakis, M., Karasali, H., & Briassoulis, C. 2014. Design of a European agrochemical plastic packaging waste management scheme: Pilot implementation in Greece. Resources, Conservation and Recycling, 87, 72–88.

Carvalho, F. P, 2017. Pesticides, environment, and food safety. Food Energy Secur. 6, 48–60.

Cooper, J. and Dobson, H., 2007. The benefits of pesticides to mankind and the environment. *Crop Protection*, *26*(9), pp.1337-1348.

CSA, 2012. Statistical report on area and production of crops and farm management practices, Central Statistical Agency, statistical bulletin 532, Addis Ababa.

Damalas, C. A.; Khan, M. 2017. Pesticide use in vegetable crops in Pakistan: Insights through an ordered probit model. Crop Prot. 99, 59–64

Damalas, C. A.; Eleftherohorinos, I. G. 2011. Pesticide exposure, Safety Issues, and risk assessment indicators. Int. J. Environ. Res. Public Health 8, 1402–1419

Damalas, C. A. 2009. Understanding benefits and risks of pesticide use. Sci. Res. Essays 4, 945–949.

Damte, T. and Tabor, G., 2015. Small-scale vegetable producers' perception of pests and pesticide uses in East Shewa zone, Ethiopia. International journal of pest management, 61(3), pp.212-219.

Dinham, B., 2004. Can new global initiatives reduce pesticide hazards? Pesticides News, 65, pp.6-8.

Fenik, J., Tankiewicz, M. and Biziuk, M., 2011. Properties and determination of pesticides in fruits and vegetables. TrAC Trends in Analytical Chemistry, 30(6), pp.814-826.

Goen, T.; Schmidt, L.; Lichtensteiger, W.; Schlumpf, M. 2017. Efficiency control of dietary pesticide intake reduction by human biomonitoring. Int. J. Hyg. Environ. Health, 220, 254 -260

Hengsdijk, H. and Jansen, H., 2006. Agricultural development in the Central Ethiopian Rift valley: A desk-study on water-related issues and knowledge to support a policy dialogue. Plant Research International BV, Wageningen, pp.1-25.

Jansen, K., and Dubois, M. 2014. Global pesticide governance by disclosure: Prior informed consent and the Rotterdam Convention. In A. Gupta & M. Mason (Eds.), Transparency in environmental governance: Critical perspectives (pp. 107–131). Cambridge, MA: MIT Press.

Jansen, H. C., and Harmsen, J., 2011. Pesticide monitoring in the Central Rift Valley 2009-2010: ecosystems for water in Ethiopia (No. 2083). Alterra.

Matthews G A., 2006. Pesticides: Health, Safety and the Environment, Blackwell Publishing, Oxford

Mekonnen, Y., and Agonafir, T. 2002. Pesticide sprayers' knowledge, attitude, and practice of pesticide use on agricultural farms of Ethiopia. Occupational Medicine, 52, 311–315.

Mengistie, B. T.; Mol, A. P. J.; Oosterveer, P, 2017. Pesticide use practices among smallholder vegetable farmers in Ethiopian Central Rift Valley. Environ. Dev. Sustain. 19, 301–324.

Mengistie, B. T., 2016. Policy-Practice Nexus: Pesticide Registration, Distribution and use in Ethiopia. SM J Environ Toxicol, 2(1), p.1006.

Mengistie, B., 2016. Environmental governance of pesticides in Ethiopian vegetable and cut flower production (Doctoral dissertation, Wageningen University).

Mengistie, B. T., Mol, A. P. J., & Oosterveer, P. 2015. Private environmental governance in the Ethiopian pesticide supply chain. NJAS - Wageningen Journal of Life Sciences.

Mengistie, B. T., Mol, A. P., Oosterveer, P., and Simane, B., 2015. Information, motivation, and resources: The missing elements in agricultural pesticide policy implementation in Ethiopia. International journal of agricultural sustainability, 13(3), pp.240-256.

Negatu, B., Kromhout, H., Mekonnen, Y. and Vermeulen, R., 2016. Use of Chemical Pesticides in Ethiopia: a cross-sectional comparative study on Knowledge, Attitude, and Practice of farmers and farmworkers in three farming systems. *The Annals of occupational hygiene*, *60*(5), pp.551-566.

Ngowi, A. V. F., Mbise, T. J., Ijani, A. S. M., London, L. and Ajayi, O. C., 2007. Smallholder vegetable farmers in Northern Tanzania: Pesticides use practices, perceptions, cost and health effects. Crop Protection, 26(11), pp.1617-1624.

PAN, U., 2006. Hazardous pesticides and health impacts in Africa. Food and Fairness briefing Pesticide Action Network UK, London, p.6.

Teklu, B. M., Adriaanse, P. I., Ter Horst, M. M., Deneer, J. W. and Van den Brink, P. J., 2015. Surface water risk assessment of pesticides in Ethiopia. *Science of the Total Environment*, *508*, pp.566-574.

Williamson, S., Ball, A. and Pretty, J., 2008. Trends in pesticide use and drivers for safer pest management in four African countries. Crop protection, 27(10), pp.1327-1334.

Yohannes, Y. B., Ikenaka, Y., Saengtienchai, A., Watanabe, K. P., Nakayama, S. M. and Ishizuka, M., 2014. Concentrations and human health risk assessment of organochlorine pesticides in edible fish species from a Rift Valley Lake—Lake Ziway, Ethiopia. Ecotoxicology and environmental safety, 106, pp.95-101.

How to cite this article:

Midekesa Chala. 2021. Review of Pesticide Use in Vegetable Farms and its Consequences in Ethiopia's Central Rift Valley. *Int.J.Curr.Res.Aca.Rev*. 9(11), 83-93. doi: https://doi.org/10.20546/ijcrar.2021.911.010