



July, 2024

Policy Paper

“A Review of Agricultural Pesticides Policies, Laws and Strategies from a Gender Perspective Approach in Palestine”

Corresponding Author: Dr. ABDUL-JALIL HAMDAN
Hebron University, Palestine. ajhamdan@hebron.edu

Disclaimer

This work was funded by the consulate general of Sweden in Jerusalem and led by We effect as a part of the Environmental and Climate Justice Program in Palestine (ECJP), this policy paper was prepared by Dr. Abdul-Jalil Hamdan, supervised and followed by Land Research Center (LRC) in cooperation with Palestinian Agricultural Institution Coalition (PAIC)¹. The views and opinions expressed in this paper don't necessarily represent the official positions and views of the organizations and the donors.

¹ PAIC: is a coalition of six Palestinian environment, climate, and agricultural non-governmental organizations- Palestinian Agriculture Relief Committee (PARC), Union of Agricultural Work Committees (UAWC), Palestinian Hydrology Group (PHG), Land Research Centre (LRC), MA'AN Development Centre, and the Applied Research Institute – Jerusalem (ARIJ).

Table of Contents

Disclaimer.....	1
Acronyms.....	4
Summary.....	5
ملخص.....	5
1. Introduction.....	6
1.1. Objectives	7
1.2. Methodology.....	8
2. Literature Review.....	9
2.1. Review of Studies on Impact of Pesticides Use on Human Health and Environment in Agriculture 9	
2.2. Review of Gender-Sensitive Analysis of the Impact of Pesticides on Women and Children	11
2.2.1. Pesticide and Fetal Growth.....	11
2.2.2. Analysis of Pesticide Exposure in the Fetus.....	11
2.2.3. Congenital Anomalies Due to Pesticide Exposure	12
2.2.4. Weight Loss in Fetus Due to Pesticide Exposure	12
2.2.5. Carcinogenic Effects of Pesticide on Fetus.....	12
2.2.6. Endocrine Disrupting of Fetus and Pesticide Exposure.....	12
2.3. Review of Studies on the Impact of Pesticides on Environment and Human Health in Palestine..	13
3. Status of Pesticide Use in Palestine	15
3.1. EQA Report on the State of the Environment in Palestine 2023.....	17
3.1.1. Available data on the import of chemicals into Palestine	17
3.1.2. Agricultural pesticides	18
3.1.3. In the Field of Legal and Institutional Development	19
4. Legal Materials: Laws, Policies, and Strategies about Pesticides in Palestine	20
4.1. Key Legal Terms Used Throughout This Document According to FAO/WHO (2015) (Annex 1)	20
4.2. Palestinian Laws Related to Pesticides:	21
4.2.1. The Law on Agriculture No. (2) of 2003 in Palestine (Annex 2)	21
4.2.2. Palestinian Environmental Law (1999)	22
4.3. Palestinian Regulations Related to Pesticides.....	23
4.3.1. Regulation No. 9 of 2012 on the system of pesticides in Palestine (Annex 3).....	23

4.3.2. Council of Ministers Resolution No. 9 of 2012 on the system of agricultural pesticides (Annex 5).....	24
4.4. Palestinian Agricultural Strategies about Pesticides	26
5. Analysis of Palestinian Legal Materials: Laws, Policies, and Strategies about Pesticides	27
5.1. Report of the Palestinian National Audit Office on the Effectiveness of the Procedures of the Relevant Authorities in Controlling the Use of Agrochemicals in the Northern Governorates (2021) .	27
5.2. Challenges and Gaps in the Enforcement of Rules and Regulations	29
5.2.1. Challenges Which Obstacle Government Institution	29
5.2.2. Gaps in Enforcement of Rules and Regulations	29
5.2.3. Access of Farmers to Agricultural Inputs	31
5.2.4. Gaps in Pesticide Regulations in Palestine.....	31
6. Recommendations on Policy, Legislation, and Registration Reforms.....	33
6.1. Suggested Policy Reforms	33
6.2. Suggested Legislation Reforms	34
6.2.1. Holistic pesticides law:	34
6.2.2. Pesticides Scientific Committee	34
6.3. Suggested Registration Reforms.....	34
6.4. Suggested Recommendations to be Included in MoA Strategy.....	35
7. Conclusions.....	36
References.....	38
Annexes	42

Acronyms

ECJP	Environmental and Climate Justice Program Palestine
EDCs	Environmental Endocrine Disrupting Chemicals
EQA	Environmental Quality Authority
FAO	Food and Agricultural Organization
IPM	Integrated Pest Management
IVM	Integrated Vector Management
GAP	Good Agricultural Practices
LRC	Land Research Centre
MA'AN	MA'AN Development Centre
MoA	Ministry of Agriculture
MoH	Ministry of Health
NGOs	Non-Governmental Organizations
PAIC	Palestinian Agricultural Institutions Coalition
PARC	Palestinian Agricultural Relief Committee
PHG	Palestinian Hydrology Group
PNA	Palestinian National Authority
PPE	Personal Protection Equipment
PPIS	Plant Protection and Inspection Services
SGP	Small Grants Program
UAWC	Union of Agricultural Work Committees
WHO	World Health Organization
ARIJ	Applied Research Institution-Jerusalem

Summary

This document supports the development of a joint policy paper on the environmental impact and monitoring of chemical pesticides, incorporating a gender perspective. It aims to revise and propose changes to the frameworks, policies and strategies associated with agricultural pesticides and to formulate recommendations that ensure environmental and climate justice within these policies and strategies.

There is a pressing need to update the current pesticide legislation and regulations, guided by a clear policy that judiciously and collaboratively utilizes its tools to rectify numerous identified strategic shortcomings.

Certain flaws cannot be overlooked due to their potential adverse effects on the health of the nation's populace and the environment. The central challenge is to manage pesticides safely and comprehensively, encompassing all pesticide types and the entirety of their lifecycle management.

In conclusion, the adoption of practical guidelines for the ground application of pesticides, personal protection during pesticide handling and application, and pesticide monitoring and management is essential. These guidelines, aligned with the international code of conduct on pesticide management, should aim to minimize pesticide exposure and impact, particularly through specific safety measures for farmworkers to safeguard farmers, children and pregnant women from exposure to pesticides.

ملخص

تدعم هذه الوثيقة تطوير ورقة سياسات مشتركة حول التأثير البيئي ورصد المبيدات الكيميائية، مع دمج منظور النوع الاجتماعي. وتهدف إلى مراجعة واقتراح تغييرات على الأطر والسياسات والاستراتيجيات المرتبطة بالمبيدات الزراعية، وصياغة التوصيات التي تضمن العدالة البيئية والمناخية ضمن هذه السياسات والاستراتيجيات.

هناك حاجة ملحة لتحديث التشريعات واللوائح الحالية المتعلقة بمبيدات الآفات، مسترشدة بسياسة واضحة تستخدم أدواتها بحكمة وتعاون لتصحيح العديد من أوجه القصور الاستراتيجية المحددة.

لا يمكن التغاضي عن بعض القصور في تطبيق التشريعات و السياسات الزراعية بسبب آثارها الضارة المحتملة على صحة المواطنين والبيئة. ويتمثل التحدي الرئيسي في إدارة مبيدات الآفات بشكل آمن وشامل، بما في ذلك جميع أنواع المبيدات ومجمل إدارة دورة حياتها.

وفي الختام، فإن هناك ضرورة لاعتماد نظام دليل مراقبة عملية التطبيق الأرضي للمبيدات الكيميائية، نظام دليل الحماية الشخصية أثناء التعامل مع المبيدات الحشرية واستخدامها، نظام دليل مراقبة المبيدات وإدارتها. وينبغي لهذه الانظمة أن تتماشى مع مدونة قواعد السلوك الدولية بشأن إدارة مبيدات الآفات وأن تهدف إلى تقليل التعرض لمبيدات الآفات وتأثيرها، لا سيما من خلال تدابير سلامة محددة لعمال المزارع لحماية المزارعين والأطفال والنساء الحوامل من التعرض للمبيدات.

“A Review of Agricultural Pesticides Policies, Laws and Strategies from a Gender Perspective Approach in Palestine”

1. Introduction

Two major concerns in the rapidly growing human population are environmental safety and food security. Serious damage caused by pests in agriculture affects productivity and incurs significant costs annually, increasing the agricultural production budget. Despite these concerns, the widespread use of chemical pesticides has been preferred due to the benefits in agriculture, especially in protecting crops from pest damage and increasing productivity. However, the use of these pesticides causes a serious threat to the environment and human health.

Agricultural pesticides are defined as the materials and compositions that are used for protection against vegetative and animal pests or in control of plant and animal diseases, rodents and weeds, and other harmful beings. Farmers are at a high risk of exposure to pesticides, particularly directly involved in the handling of pesticides during mixing and spraying, working in the treated fields and from residues on food and drinking water. It is important to note that these effects can be more serious for women and children working in family farming businesses.

Furthermore, injudicious use of pesticides can lead to the destruction of non-target species, loss of biodiversity and contamination of soil, water and air. Therefore, this review work is focused on the hazardous effect of chemical pesticides on human health and the environment (Kumar, 2020).

Pesticides play an integral role in today's farming. However, indiscriminate and incorrect use can harm human health and the environment worldwide. Pesticide poisoning is a global public and occupational health problem and accounts for nearly 300,000 deaths worldwide every year, the majority of which are from developing countries (Mahmood et. al., 2016, Sabarwal et. al., 2018).

Acute pesticide poisonings have been reported as a major consequence in the farming community and the extent of poisoning in these workers, particularly in less developed countries, has often been based on inadequate information (Litchfield, 2005). Human exposure to pesticides can occur in many ways: occupational exposures, dietary residues, ambient outdoor and indoor exposures, contamination of drinking water and unsafe use of pesticides on domestic animals (Greenpeace-International, Pesticides and Our Health, 2015). Poison control center's data indicate that from all types of accidental poisoning, pesticides are responsible for 3.6% of adult and 3.4% of pediatric deaths (Gummin, et. al., 2017).

In Palestine, as in many other developing countries, the lack of regular pesticide analysis and control in groundwater makes it difficult to integrate knowledge and examine their relation to the soil under local conditions. More than 1000 tonnes of pesticides used in the Gaza Strip represented 75 different kinds of pesticides, 19 of which were internationally prohibited (Safi et. al., 1993). In cooperation with Adam Smith, a British pesticide expert, the Palestinian National Committee identified in 2007 only 242 active ingredients that are adequate for use and permitted for application in the agricultural and public health sectors (Ministry of Agriculture, 2008).

In 2010, the Palestinian Authority Central Bureau of Statistics described the use of pesticides in the West Bank and Gaza as “excessive”, risking reduced soil fertility and water pollution. It noted then that “In the West Bank the annual rate of use of agricultural fertilizers reached 30,000 tons of chemical fertilizers and manures, and the annual rate of use of pesticides reached 502.7 tons, consisting of about 123 types, 14 of them is internationally banned for health reasons”(PCBS, 2010).

Due to a lack of knowledge farmers sometimes face great risks of exposure, particularly when they use toxic chemicals that are banned, apply incorrect methods, use poorly maintained or inappropriate spraying equipment, reuse pesticide containers for food storage and neglect personal protective equipment (PPE) and other safety measures.

This policy paper presents the main issues caused by a lack of monitoring and enforcement of policies regulating the use and trade of agricultural inputs by the relevant Palestinian regulatory bodies in the West Bank and provides recommendations for different stakeholders working in the sub-sector about how to reduce this.

1.1. Objectives

The primary objective of this study is to produce a comprehensive Policy Paper that thoroughly examines laws, policies and strategies related to pesticides in Palestine from a gender perspective approach. Additionally, the paper will emphasize the effects of pesticides on vulnerable groups, including Women, Girls, People with Disabilities and Children. The specific objectives are:

A. Environmental and Climate Justice Integration

Advocate for the integration of environmental and climate justice considerations within sectorial policies, specifically in the context of pesticide usage.

B. Legal and Regulatory Analysis

Identify and address discrepancies between existing laws and regulatory frameworks concerning pesticide usage, disposal and environmental monitoring. Focus on harmonization with national

plans and the Palestinian constitution, ensuring alignment with principles of environmental rights, gender equality and human rights.

1.2. Methodology

Data for this research was gathered through three main methods:

1. Literature review on the following aspects:
 - Review of Studies Impact of Pesticides Use on Human Health and Environment in Agriculture
 - Review on Gender-Sensitive Analysis of the Impact of Pesticides on Women and Children
 - Review of Studies on the Impact of Pesticides on Environment and Human Health in Palestine
 - Review on Status of Pesticide Use in Palestine.
2. Analysis of Palestinian legal materials: laws, policies, and strategies about pesticides.
3. Interviews: To maximize the quality and credibility of this paper, significant efforts have been made to conduct interviews. Zoom workshops were conducted by the participating (PAIC) institution. In addition, communications were conducted by emailing personnel responsible for the directorate of plant protection in the Palestinian Ministry of Agriculture and collecting answers from individuals working for government institutions. Participants were chosen for the communications on the basis that they most likely have accurate and sufficient knowledge of and insights into the issues.

2. Literature Review

2.1. Review of Studies on Impact of Pesticides Use on Human Health and Environment in Agriculture

Extensive use of pesticides with residual contents exceeding the maximum residue limits on produce caused many European countries to ban certain agricultural exports from several Arab countries (Bashour, 2008). Indeed, the sale and handling of pesticides are not regulated and there is no control over the use of pesticides. Accredited labs for pesticide residue analysis are scarce in many Arab countries. Palestine, like other Arab countries, is plagued by uncontrolled use, unsafe handling, and misuse of pesticides in a proliferating range (Al-Sa'ed et. al., 2011). The shortage of reliable data has alerted the scientific community and to some extent the general public to the need for facts on the potential health hazards of pesticides through their indiscriminate use.

Asghar et. al., (2016) reviewed pesticide exposure and human health. This study was conducted at the Department of Zoology, University of Gujrat, Pakistan during 2014-2015. The data for the last two decades regarding pesticide exposure and human health was compiled through a thorough review of thirty-three research articles published in various journals of international status. The data analysis of international researchers revealed that extensive use of pesticides increases their exposure to humans which greatly increases the risk of cancer, neural and birth defects. The way of pesticide exposure and their health outcomes include neurological, fetal growth, birth and cancerous outcomes. Several pesticides were found to be effective as neurotoxins and cause neuronal disorder and degenerative diseases, some affect fetal growth and cause congenital anomalies and others are carcinogenic for humans.

Asghar et. al., (2016) concluded that pesticide exposure is not only harmful to adults, but young children and fetuses during their developmental period are more vulnerable to these pesticides due to their weak and inactive immune systems. The most harmful effects of pesticides for both adults and children are due to their carcinogenic effects. This exposure causes childhood and adult leukemia, bladder, clone, thyroid and brain cancer in exposed persons. In addition, they found that pesticides are very harmful if they are exposed to humans, thus it is to reduce their exposure and effect, by using specific safety measures for farm workers and reducing exposure of children and pregnant females.

Kumar (2020) studied the human health and environmental effects of Pesticide Use in Agriculture and found that the large-scale and injudicious use of pesticides has created alarming concerns about the adverse effects on human health and the environment. The non-target organisms, particularly insects' natural enemies and pollinators, have gotten the most attention

about the adverse effects of pesticides because of their value in integrated pest management (IPM) and pollination processes, respectively. Natural enemies play an important role in controlling pest population levels; therefore, the destruction of these by using pesticides can activate pest problems.

The secondary pest outbreaks are also caused by the loss of predator species. Because of the indiscriminate use of pesticides in agriculture, the quality of soil and aquatic environment are also adversely affected to a considerable level along with the natural enemies. Pesticides degrade soil invertebrates including earthworms, nematodes, and other small organisms that have an important role in the soil ecosystem.

Kumar (2020) found that several studies have shown that chronic diseases like cancers, fertility problems, depression, diabetes, respiratory diseases, and neurological disorders occur due to the use of pesticides. Epidemiological studies in humans indicated that the second most common cancer in men, after lung cancer is prostate cancer found mostly in male farm workers of age above 50 years, due to the use of chlorinated pesticides and methyl bromide.

Kumar (2020) suggested that pesticides can pass into the human body through inhalation, oral or dermal exposure and become the main cause of several diseases like cancer, respiratory diseases, skin diseases, endocrine disruption and reproduction disorders. He concluded that there are various ways to protect human health and environmental hazards as a result of indiscriminate use of pesticides in agriculture, the development and use of safe and environmentally friendly pesticide formulations, the introduction of alternative pest control master plans in an IPM approach such as host plant resistance and bio-control.

Tessema et. al., (2021) studied pesticide use, perceived health risks and management in Ethiopia and Hungary: a comparative analysis and suggested that pesticides play a very important role in ensuring food security and economic growth but their use can cause harmful effects on human health and the environment. This study aimed to investigate the level of knowledge, health risk perceptions and experiences on the practice of pesticide use and management among extension officers in Ethiopia and plant doctors in Hungary.

Tessema et al (2021) mentioned a significant proportion of officers from both countries reported inappropriate methods of pesticide residue disposal. These observations pointed out that the situation of pesticide use and knowledge and management of pesticide products is better in Hungary; nevertheless, the issue continues to need more attention in both settings.

2.2. Review of Gender-Sensitive Analysis of the Impact of Pesticides on Women and Children

In Palestine, regarding toxicity symptoms associated with pesticides, Safi et. al., (1993) showed that common self-reported toxicity symptoms among farm workers were burning sensation in the eyes/face, dizziness, cold/breathlessness/chest pain, itching/skin irritation and headache. He called for urgent prevention, intervention and protection from the Ministry of Health and other non-governmental organizations.

Asghar et al (2016) reviewed pesticide effect on women and children and summarized the health impact of pesticides on women and children as follows:

2.2.1. Pesticide and Fetal Growth

It is estimated that 54% of women in a cohort of prenatal and early postnatal mothers in Spain were exposed to pesticides during their pregnancy and 47% were due to pesticides used elsewhere in the home. Women are exposed to these pesticides through inhalation, ingestion, or contact with the skin (Sabrina et. al., 2012). In small children, exposure is more dangerous because they ingest dust that is contaminated, and their breathing zone is closed to the ground containing pesticide remains, they spend more time in homes with large exposed body surfaces due to the fewer clothes. The fetus and children have a weak immune system which is not able to detoxify pesticides, thus, in case of their exposure they are more vulnerable.

2.2.2. Analysis of Pesticide Exposure in the Fetus

The estimation of pesticide exposure in fetuses is estimated by the analysis of blood from the umbilical cord and placenta, but it only shows the recently exposed and persistent pesticides (Rojas et. al., (2000). In different research by examining the samples taken from body parts, hairs, umbilical cord blood and meconium of fetus, it was found that meconium contains the highest exposure to pesticide residue, and it contains almost all potential pesticides to which pregnant females exposed during their gestation period and the majority of detected pesticide are used in houses include propoxur, pretilachlor, DDT, cyfluthrin and cypermethrin, blood and hairs do not contain all pesticide to which mother exposed during pregnancy so it revealed that meconium is most sensitive part for pesticide exposure in the infant (Enrique et. al., 2008).

2.2.3. Congenital Anomalies Due to Pesticide Exposure

In a study it was found that mother periconceptional pregnancy exposure to pesticides causes various congenital anomalies including orofacial clefts, neural tube defects, conotruncal defects, or limb anomalies, the mothers involved in the use of pesticides for household gardening or living within 0.25 miles of the agricultural area shows high risk of these defects in their offspring congenital malformation found attributable fraction of 54.4% (Rojas et.al., 2000).

2.2.4. Weight Loss in Fetus Due to Pesticide Exposure

Pesticide exposure affects the growth of fetuses especially causing weight loss, exposure to a mixture of pesticides shows more adverse effects, in a study on 20 different pesticides (10 insecticides, 6 herbicides, 3 fungicides, and 1 repellent), it was found that 2 pesticides (diethyltoluamide and vinclozolin) present in greater frequency in the blood of umbilical cord fetus and fetus weight is inversely proportional to the pesticide number and decreased by a mean of 37.1 g per detected pesticide. A mixture of pesticides especially two fungicides (Vinclozolin and Acetochlor) shows more harmful effects on fetus growth (Erin et. al., 2012).

2.2.5. Carcinogenic Effects of Pesticide on Fetus

Carcinogenic pesticides also affect the fetus during or after gestation, the presence of pesticides in maternal cord blood demonstrated that they transfer from mother to fetus during the gestation period and it may increase the risk of cancer. If exposure is before conception it causes epigenetic alternation in gene expression like imprinting and methylation of DNA in the parent's gametes. After conception, exposure causes an alternation of immunological and hormonal functions and also causes a mutation in somatic cells of the fetus which causes cancer, especially brain cancer. Recent research elaborates that the risk of brain cancer is 2-fold higher in those children whose mothers were exposed to agricultural pesticides especially herbicides during their jobs (Youn et. al., 2009).

2.2.6. Endocrine Disrupting of Fetus and Pesticide Exposure

A research finding elaborates that 5 pesticides (Bioethanol, Propiconazole, Cypermethrin, Malathion, and Terbutylazine) exposure have a high level of endocrine disruption in humans. Some persistent pesticides like organochlorine, polychlorinated biphenyls, and polybrominated biphenyl ethers are lipophilic and bind with lipids of serum. Other pesticides, azole (fungicide) and atrazine affect by increasing gestational length and disrupt the endocrine system of the fetus; if it is during the early phase of gestation then the reproductive organs of the fetus fail to develop (Rossana et. al., 2013). Environmental endocrine-disrupting chemicals (EDCs) disrupt the

endocrine system of fetuses if they are exposed to them, in utero or early childhood. It causes growth and gestational age defects.

Recent research (Wohlfahrt et. al., 2010) shows that overweight and obesity defects are due to exposure to pesticides extensively used in houses and agricultural areas and it leads to a high risk of metabolic and cardiovascular diseases.

2.3. Review of Studies on the Impact of Pesticides on Environment and Human Health in Palestine

Adequate knowledge of pesticide health risks, proper attitude towards pesticide use and adequate storage and handling of pesticides with appropriate application of a full set of personal protective equipment are crucial to prevent morbidity and mortality from pesticide exposure. The problem of agricultural pesticides in Arab countries is not only an issue of uncontrolled use but also pertains to the handling, misuse and disposal of unwanted pesticides. This is exacerbated by undeveloped national laws and regulations regarding the potential fate and residual impacts of pesticides on groundwater, food safety and public health.

Issa et al (2010) studied pesticide use and opportunities for exposure among farmers and their families: cross-sectional studies 1998-2006 from Hebron governorate, Occupied Palestinian Territory. The objective of this study was to compare patterns of pesticide use in Beit-U'mmar village, West Bank, between 1998 and 2006. They concluded that the results were based on two cross-sectional surveys and should be interpreted with caution due to potential validity problems.

The results of this study suggested some positive changes in the handling of pesticides amongst participants in 2006, which could be due to different policy interventions and regulations that were implemented after 1998. However, farm workers in Beit-U'mmar village are still at risk of health effects because of ongoing exposure to pesticides.

Issa et al (2010) mentioned that, to the best of their knowledge, no studies on long-term changes in pesticide use have been reported from developing countries.

Al-Sa'ed et al (2011) conducted a national survey on the use of agricultural pesticides in Palestine. Results indicated a trend of increasing use over the period 1996 to 2007. Analysis of the annual pesticide applications in agricultural farms within the northern districts of the West Bank revealed a drastic reduction in the quantities used for all pesticide types. Compared with 1996, the amount applied during 2007 revealed a reduction in the various types (30% insecticides, around 53% fungicides, 64% herbicides, and 20% entails soil disinfecting agents.

Al-Sa'ed et. al., (2011) concluded that:

- The MoH and MoA require strong management to control hazardous and toxic pesticides in public health and agricultural sectors.
- Relevant authorities, the Palestinian Water Authority and Environmental Quality Authority must improve sanitation and solid waste services to minimize water pollution to domestic and agricultural wells (groundwater) by pesticide toxicants.
- The majority of respondents replied aware of the hazardous impacts of pesticides, however, gave unjustified arguments as to applying safety measures in usage, storage, or disposal of used pesticide bottles or obsolete residues.
- Technical guidelines on pesticide storage, stock control and disposal of both bulk and small quantities of unwanted and obsolete pesticides with technical provisions. Control and monitoring of pesticide usage, evaluation of pesticide residues and pollution assessment of soil, produce and aquatic environment are urgent activities to minimize adverse pesticide impacts.

Issa et al (2017) conducted a study to classify and evaluate pesticides used in Palestine - by studying types used during the period (2012 – 2015) based on their severity on environment and health. Data about pesticides including types and annual consumption was obtained from the Ministry of Agriculture. Consumption annual variations were noticed, with the highest consumption in 2012. They found that the general trend indicated that herbicides contributed half of the average total consumption, whereas a tenth of the used pesticides are classified as extremely and highly hazardous chemicals. In addition, two-thirds are found to be persistent compounds in soil, and three-quarters of the types are persistent in water.

Issa et al (2017) concluded that further analytical researches on pesticide residue are needed, which will assist policy-makers in reformulating the current pesticide management and controlling system.

3. Status of Pesticide Use in Palestine

The use of pesticides is still considered a major way to protect and increase crop yields in less developed countries, particularly. Palestine is one of the countries in which agricultural production relies on pesticides. Different studies showed that the usage of pesticides in Palestine should be more managed and regulated based on their types, toxicities and persistence in environmental components.

In Palestine, pesticide usage has been increasing significantly to improve agricultural production (Yacoub 2003), which is one of the main sectors that provide both economic and food sources to Palestinians as it contributes 5.6% of the Gross Domestic Production and 21% of the total exports (Ministry of Agriculture 2014).

Issa et al. (2010) showed that in 1998, a total of 47 formulated pesticides were used. In 2006, 16 of these pesticides were still in use, including five compounds that had been internationally banned (Azinphosmethyl; Cypermethrin; Dichlorvos; Dimethoate; and Triadmenol). The study concluded that there were positive changes in using pesticides, such as the classification and evaluation of pesticides used in Palestine based on their severity on health and environment consuming less quantities of pesticides (for example, there has been a reduction in pesticide usage from 1388 tons to 977 tons in 2005 and 2006, respectively), applying the recommended dosage and complying with the safety period. These positive changes could be due to different policy interventions and regulations that were implemented after 1998 (Issa et al. 2010).

In a national survey on the use of agricultural pesticides in Palestine in 2011 (Al-Sa'ed, et. al., 2011), the researchers reported that the consumption of pesticides in the Gaza Strip was 0.77 liter/dunum and 0.18 liter/dunum in the West Bank. A decrease in the consumption trend was observed in the studied districts.

Zyoud et al. (2010) concluded that legislation promoting the use of safer pesticides is also needed. Sawalha (2012) reported that the Ministry of Agriculture (MoA), and Ministry of Health, together with non-governmental organizations (NGOs) are trying to control the use of pesticides and encourage farmers to use organic farming. In addition, they always warn against the misuse of pesticides on human life and demand legal actions to prevent the introduction of toxic and illegal pesticides into agricultural areas.

Issa Yaser (2017) evaluated pesticides used in Palestine - by studying types used during the period of (2012 – 2015). Consumption annual variations were noticed, with the highest consumption in 2012. The general trend indicated that herbicides contributed half of the average total consumption. These variations could be explained as a result of precipitation fluctuations during these years. Krzm (2013) reported that, in 2012, the total average rainfall around Palestine reached about 110% of the cumulative annual average which affected the growth of weeds and agricultural production.

Issa Yaser (2017) concluded that insecticides contributed 34% of the average total consumption, followed by fungicides (16%), whereas the lowest portion was for rodenticides, whose consumption did not exceed 0.1% of the total average. Among the 50 active ingredients that were studied, results indicated that the majority of the active ingredients were under the Phosphono-glycine group which contributed 38% of the average total consumption during the four years.

Issa (2017) concluded that hazardous and persistent chemical pesticides are still the major choice for most Palestinian farmers despite the increase in pesticide-related adverse effects and the development of alternative pest control methods such as integrated pest management (IPM), genetic control, and biological control. Despite all efforts conducted by the authorities and academics, hazardous pesticides are still in use by Palestinian farmers.

Issa (2017) found that 4% and 6% of the consumed pesticides are classified under the WHO guidelines as extremely and highly hazardous chemicals, respectively. In addition, 36% are moderately hazardous, which means that about half of the used pesticides have significant hazardous toxicities that cannot be ignored. He also concluded that persistent pesticides are still used by farmers as it was found that 66% and 72% of the average total consumption during the period that the study covered are persistent compounds in soil and water, respectively. Keeping in use of these harmful types of pesticides actually will affect the quality of life, damage the environment, and put the population at risk of drinking highly contaminated water, breathing polluted air, and consuming crops with high pesticide residues.

Since its establishment in Palestine, the Small Grants Program (SGP) is concerned with the focal area of “Chemicals and Solid Waste Use”. Several grants were endorsed for projects aimed at reducing the use of chemicals, especially in the field of sustainable agriculture, as well as the sound management of solid waste.

Several case studies have been conducted Towards Sustainable Environmental Agriculture and the Sound Management of Solid Waste in Palestine (2020). The projects that were sponsored by SGP during the year 2018 / 2019 are as follows:

- **Case Study 1: “Improving the Farm Producers’ Attitudes in Pesticide Use in the West Bank: Positive Impacts of Applying Good Agricultural Practices” Project, Implemented by the Land Research Center (LRC) (Husani and Attawneh, 2020).**

The main objective of this project is to monitor the use of agrochemicals "Pesticides" in the West Bank, to minimize their misuse in a manner that ensures not exceeding the Maximum Residue Level (MRL), and to maintain good agricultural practices.

Up to 54 samples of tomato and cucumber were analyzed (27 samples of each crop variety). Samples were collected from three governorates, Hebron, Jericho (The Jordan Valley area) and Jenin; noting that the average weight of one sample is about 800 grams.

The results of the project showed the adverse effects of pesticide management by farmers, in terms of pesticide quality and quantity. It was found that there was more than one type of agrochemical compound in the tested samples, whereas in some samples up to 4 chemical compounds were found per sample (as a mixture of fungicides and insecticides).

Therefore, the results of the project indicated that profitability and high production of crops free of diseases; both insect and fungal disease, come at the expense of the nutritional value of the produced vegetables, food security, and the environment.

● **Case Study 2: “Comparison of Soil Fertility Levels and Pesticide Residues between Chemical and Ecological Agriculture in Wadi Fukin Village” Project, Implemented by MA’AN Development Center (Hamdan et. al., 2020).**

The objective of the study was to contribute to publicizing and promoting the adoption of ecological farming patterns among farmers, especially those practicing intensive chemical farming to obtain safe food free from agrochemicals and the consequent achievement of Palestinian sovereignty over food.

Six questionnaires were filled with male/female farmers from the village of Wadi-Fukin; three of them are practicing environmental farming and another three are practicing chemical farming. 18 soil samples and 14 vegetable samples were collected for analysis.

The results showed that the application of agroecological and environmental practices shall improve soil fertility, provide nutrients needed for plants, and provide safe healthy food for members of the community.

3.1. EQA Report on the State of the Environment in Palestine 2023

EQA reported on the state of the environment in Palestine in 2023, specifically focusing on the import of chemicals and pesticides.

3.1.1. Available data on the import of chemicals into Palestine

This section discusses the import of chemicals and fertilizers in Palestine, including data from various ministries and the Environmental Quality Authority. It covers the number of import permits granted, the decline in import quantities, the types of pesticides imported and the

approval process for pesticide suppliers. It also mentions the import of agricultural fertilizers and the percentage of approved fertilizers that were imported.

- The Environmental Quality Authority granted 121 permits to import chemicals in 2022.
- The Ministry of Agriculture imported between one million and 1.6 million liters of pesticides annually.
- Insecticides constitute 60% of the quantities of imported pesticides, fungicides constitute 35%, and herbicides constitute 5%.
- The Environmental Quality Authority granted import permits for about 1.5% of imported pesticides.
- In 2022, 57 thousand tons and 17 thousand cubic meters of agricultural fertilizers were imported into Palestine.

3.1.2. Agricultural pesticides

This section discusses the current state of pesticide use in Palestine, including the absence of a local pesticide factory, the lack of a recent pesticide guide and the ongoing process of re-registering pesticides. It also highlights the criteria for canceling pesticide registrations and the role of various organizations in ensuring health and environmental considerations. The section emphasizes the need for clarity in the registration and banning of pesticides, the limited availability of safer and organic alternatives.

- All pesticides in Palestine are imported as there is no local pesticide factory.
- The Ministry of Agriculture is responsible for preparing a guide to pesticides permitted in Palestine, but the last guide was in 2014.
- Pesticide registrations are valid for three years, and cancellation can occur for various reasons, including new features, expiration, loss of effectiveness, environmental concerns, and forged documents.
- The Ministry of Agriculture has reconstituted the Scientific Committee for Agricultural Pesticides to re-register pesticides and issue a new list.
- Prohibited pesticides include those banned in Palestine, the country of origin, and those classified as carcinogenic or highly toxic.
- Twelve pesticides in the 2014 guide were banned in the European Union, and the re-registration process may ban them in Palestine as well.
- The Ministry of Health imports pesticides for disease control, which may not be on the agricultural pesticide list.
- Limited organic pesticides are available, but the Ministry of Agriculture cannot force importers to prioritize safer options.

- The shift towards a circular economy requires policies that promote the use of safer pesticides and alternatives to chemical pesticides.

3.1.3. In the Field of Legal and Institutional Development

The document outlines various measures to improve the management of hazardous materials and waste. This includes amending laws, developing monitoring mechanisms and strengthening oversight and enforcement. The document also emphasizes the need to develop technical capabilities, review international agreements and accelerate court proceedings related to chemicals.

4. Legal Materials: Laws, Policies, and Strategies about Pesticides in Palestine

The Paris Economic Protocol was signed on 29/04/1994 between the Palestinians and Israelis. It contains 83 articles and it is applied under the Palestinian-Israeli Joint Economic Committee (JEC). The agriculture sector between the two parties was regulated under 12 articles (Article 3 and Articles 51- 61). Article 3 refers to importing agricultural goods through the use of the Harmonized Commodity Description and Coding System and Article 55 includes several explanations relevant to pesticides and chemicals. However, according to a review of the implementation of the protocol conducted by the Palestine Economic Policy Research Institute (MAS) in 2013, many of these articles have not been applied or enforced by the Israeli government since the inception of the protocol.

International conventions like the Stockholm Convention on Persistent Organic Pollutants (POPs), the Basel Convention, and the Rotterdam Convention (PIC) regulate the transfer and movement of pesticides between countries. Israel signed these conventions in 2014 and the State of Palestine acceded to these conventions on 29 December 2017, with entry into force scheduled for 29 March 2018. Accession to these conventions will be vital to combating some of the main issues in the pesticide supply chain, mainly the transboundary movement of expired and illegal/restricted pesticides from Israel into the occupied Palestinian

4.1. Key Legal Terms Used Throughout This Document According to FAO/WHO (2015) (Annex 1)

The regulatory framework for the control of pesticides encompasses the full set of different types of legislation governing the management of pesticides. Besides pesticide legislation, this may for instance include legislation on environmental protection, public health, occupational health, water, food safety, wildlife, marine protection, plant protection and general chemicals management. The regulatory framework also includes obligations under international instruments.

Pesticide legislation refers to legal instruments specifically designed to control pesticides. The term, pesticide legislation, may refer to a primary instrument, often a Law, Act, or Ordinance, as well as several secondary or subsidiary legal instruments, such as Regulations, Decrees, Rules, or Notices.

The Pesticide Law, or similar primary instrument, provides the core part of the pesticide legislation. It establishes principles, mandates and responsibilities. Its adoption generally involves parliamentary approval.

Pesticide Regulations, or other secondary legislation (also referred to as subsidiary legislation or implementing legislation), further regulate specific areas of the Pesticide Law in greater detail. Generally, these can be issued at the Ministerial level.

4.2. Palestinian Laws Related to Pesticides:

4.2.1. The Law on Agriculture No. (2) of 2003 in Palestine (Annex 2)

The law consists of 85 Articles in 10 Chapters.

CHAPTER ONE (DEFINITIONS)

Article (1)

For the implementation of the provisions of this Law, the following words and expressions shall have the meanings designated thereto hereunder unless the context indicates otherwise:

Agricultural pesticides: The material and compositions that are used for protection against plant and animal pests or in control of plant and animal diseases, rodents and weeds, and other harmful beings.

CHAPTER II (PESTICIDES)

Chapter II outlines the regulations related to Pesticides in the law of agriculture in Palestine:

Article (48)

Pesticides may not be manufactured, prepared, produced, imported, distributed, sold, stored, or traded without the obtaining of special permission from the Ministry and by the conditions listed thereon.

Article (49)

Each package or container, in which any pesticide is sold, shall bear the card of the statement of the article. The names of the producer and importer, the name of the pesticide, the degree of its toxicity, antibiotics scientifically certified for the treatment of such toxicity in the event of actual injury, description of usage, period of validity and any other expedient information to protect against its hazards shall be written on it [the card] in the Arabic language.

Article (50)

All persons working in the manufacturing, importing, distribution, storage, packaging, trading, or dealing with pesticides in any form whatsoever must apply to obtain the approvals prescribed under this Law within three months from the date of its enforcement.

Article (51)

A) The Ministry shall specify and announce the following:

1. The types of agricultural pesticides allowed to be used.

2. Technical specifications and information related to pesticides.
 3. Safety conditions of their use, transportation and storage as well as description of use.
 4. Degree of their toxicity and levels of maximum limits of their remainders in the plants and soil.
 5. Procedures of their registration as well as the registration form which is kept by persons working in pesticides and its regulation.
- B) The Ministry shall establish a committee, the task of which is to specify the scientific names of agricultural pesticides and pests.
- o Law No. (11) of 2005 amended certain provisions under the Law on Agriculture No. (2) of 2003.

4.2.2 Palestinian Environmental Law (1999)

While not specific to pesticides, the Palestinian Environmental Law addresses various environmental matters, including hazardous substances and waste.

This basic enactment of the Palestinian legislation creates a framework for the protection of the environment, public health, and biodiversity in Palestine including marine areas. Its 82 sections are divided into 5 Titles:

- i. Definitions and general provisions;
- ii. Environmental protection;
- iii. Environmental impact assessment, licensing,
- iv. inspection and administrative procedure; Penalties; and
- v. Final provisions.

Article 1 contains an extensive list of definitions, including "natural reserves" and "international waters".

Objectives of this Law are set out in Article 2. Article 3 states the right of any person to complain or initiate legal proceedings against natural or juridical persons causing harm to the environment and the right to obtain official information regarding environmental impact.

Chapter 1 includes provisions regarding the manufacturing, importation, distribution, use and storage of pesticides and fertilizers and provisions that deal with desertification and drifting of land. Specialized agencies (not defined), in coordination with the Ministry of Environmental Affairs shall devise a public policy for land use (art. 6).

The Ministry shall also devise instructions and standards for the use of agro-chemicals (art. 15). Transportation of soil of arable land for purposes other than farming is strictly prohibited under section 18.

4.3. Palestinian Regulations Related to Pesticides

In Palestine, the following regulations govern the use of pesticides:

4.3.1. Regulation No. 9 of 2012 on the system of pesticides in Palestine (Annex 3)

Certainly, Regulation No. 9 of 2012 addresses the management of agricultural pesticides in the Palestinian Authority territory.

This regulation sets rules related to the import, export and registration processes for pesticides. It defines significant terms and establishes a scientific committee for pesticides. The regulation also outlines conditions for pesticide registration and specifies cases in which pesticide registrations may be canceled.

Some key points from this regulation:

Objective: The regulation aims to establish a strict system for managing pesticides, focusing on import, export and registration processes within the Palestinian Authority.

Definitions: The regulation includes definitions of significant terms related to pesticides.

Prohibited Pesticides: Article 4 outlines specific criteria for prohibited pesticides:

- Pesticides banned for use in the Occupied West Bank.
- Pesticides are banned for use in their country of origin due to health or environmental reasons.
- Pesticides are classified by the World Health Organization or the US Environmental Protection Agency as causing cancer, birth defects, genetic mutations, or severe toxicity to humans or animals.
- Pesticides that are groundwater pollutants.

Importation Conditions: Article 5 specifies purposes for which pesticide importation is permitted without registration.

Registration Procedures: The regulation provides detailed procedures for registering pesticides. Registered pesticides can be canceled under various circumstances, including new properties emerging after registration or potential local environmental damage.

Strict Import Conditions: Importers must meet strict conditions, such as obtaining written consent from the Ministry of National Economy, ensuring Arabic labeling, and maintaining records of pesticide types and amounts.

This Regulation sets rules on pesticides in terms of import, export and registration processes. It lays down some definitions of significant terms (Art.1).

A scientific committee for pesticides will be established, article (2) sets forth the responsibilities of this committee. The Regulation states the case in which the registration of pesticides should be canceled. The agricultural pesticide system in Palestine works to regulate and monitor the use of agricultural pesticides. This system includes the Scientific Committee for Agricultural Pesticides, which determines the types of pesticides allowed to be traded, imported, and manufactured, and determines the methods of using them. The committee also evaluates pesticides circulating in the Palestinian areas and re-registers them.

Agricultural pesticides are substances used in agriculture to prevent or eliminate agricultural pests. This includes chemicals such as hormones, growth regulators and leaf and flower drop materials, which are used to protect crops before or after harvest or during storage or transportation. The Scientific Committee for Agricultural Pesticides yearly recommends the list of the registered pesticides for use in Palestine (2022) (**Annex 4**).

4.3.2. Council of Ministers Resolution No. 9 of 2012 on the system of agricultural pesticides (Annex 5)

This resolution aims to create a strict pesticide management system within the Palestinian Authority territory. It covers rules for pesticide import, export, and registration processes. Some conditions for pesticide import include having written consent from the Ministry of National Economy, using Arabic labels, and maintaining records of pesticide types and amounts.

The council of ministries in Palestine has admitted a regulation on the system of pesticides (Regulation No. (9), 2012 regarding the system of agricultural pesticides) to control pesticide usage in the Palestinian territories. This Regulation sets rules on pesticides in terms of import, export, and registration processes.

This Regulation consisting of 73 articles aims at issuing a strict pesticide management system in the Palestinian Authority territory setting rules on pesticides in terms of import, export and registration processes.

It established a Scientific Committee to determine the types of pesticides that can be used and to monitor and control their quality. The committee is also charged with publishing each year and

distributing to stakeholders. A list of pesticides that have been registered and canceled and the reason for their cancellation.

It lays down some definitions of significant terms (Art.1).

Article 4 prohibits the use of pesticides that are

- (i) Banned for use in the Occupied West Bank;
- (ii) Banned for use in their country of origin for health or environmental reasons;
- (iii) Classified by the World Health Organization or the US Environmental Protection Agency as causing cancer birth defects genetic mutations, or severe toxicity to humans or animals; and
- (iv) Being groundwater pollutants. Article 5 lists the purposes for which the importation of pesticides without registration.
- (v) The Regulation explains in detail the procedures for registering pesticides.

Registered pesticides can be canceled for reasons, including

- (i) New properties emerging after registration;
- (ii) If it appears that the use of the pesticide in the local conditions may cause local damage to the environment;
- (iii) If as a result of random sampling the pesticide does not meet the specifications or technical regulations;
- (iv) Registration is canceled in the country of origin, and
- (v) Prohibition is recommended by official international organizations.

Additionally, there are strict conditions regarding the import of pesticides, such as

- (i) Importers must have written consent from the Ministry of National Economy;
- (ii) The label must be in Arabic;
- (iii) Dealers must have a license
- (iv) Dealers must have full Palestinian citizenship
- (v) The shop must have a full-time engineer who holds:
 - a Bachelor's degree in agricultural science, or
 - a degree or diploma from an agricultural institute, with not less than ten years of experience in this field
- (vi) The trader must keep records of types and amounts of pesticides, and their source; and
 - (i) Pesticides must be in their original container.

4.4. Palestinian Agricultural Strategies about Pesticides

Plant protection services play a vital role in protecting agricultural plant production through the implementation of regulations, as well as phytosanitary measures that prevent the introduction and spread of agricultural pests at the national level. These services provide all international trade requirements and agreements related to plant protection and quarantine.

MoA is the competent authority responsible for recording, controlling, and regulating all national trading operations and the use of agricultural pesticides. The Ministry has also a key role in determining the safe use of pesticides and chemicals, as well as rationalizing their use and direct effects on agriculture, the environment, and food safety. Moreover, the private sector undertakes some extension activities in this area, focusing on marketing aspects.

In addition to laws and regulations, the Ministry of Agriculture has also issued several strategies and policies that guide the services provided and the strategic direction of the agency.

1. Ministry of Agriculture. 2009. The Palestinian Agricultural Sector Strategic objectives and priority interventions (General Guidelines). Palestinian National Authority.
2. AGRICULTURE SECTOR STRATEGY “A SHARED VISION” 2011-2013. Agricultural Sector Strategy: A Common Vision (fao.org) (2009)
3. Palestinian National Agricultural Extension Strategy 2012.
4. The State of Palestine, Ministry of Agriculture (2016). National Agricultural Sector Strategy (2017-2022), “Resilience and Sustainable Development” (2016).

The current strategy (entitled ‘Resilience and Sustainable Development’) covering the years 2017-2022, states that the “MoA is the competent authority responsible for recording, controlling and regulating all national trading operations and use of agricultural pesticides.

The Ministry has also a key role in determining the safe use of pesticides and chemicals, as well as rationalizing their use and direct effects on agriculture, the environment, and food safety (MoA Strategy 2017-2022, pg.15).

The strategy stipulates that the MoA aims to strengthen its role, as well as the role of customs control and the General Authority for Borders and Crossings in combatting the smuggling of inputs that do not comply with Palestinian national standards. The strategy also addresses the issue of the cost of inputs for farmers by planning to develop initiatives and policies to reduce the cost of inputs, specifically fertilizers, and pesticides.

5. Analysis of Palestinian Legal Materials: Laws, Policies and Strategies about Pesticides

5.1. Report of the Palestinian National Audit Office on the Effectiveness of the Procedures of the Relevant Authorities in Controlling the Use of Agrochemicals in the Northern Governorates (2021)

This report addresses the effectiveness of procedures in controlling the use of agricultural chemicals, to verify that the regulatory procedures carried out by the relevant authorities contribute effectively to the optimal use of agricultural chemicals. The report touched on the evaluation of the procedures undertaken by the Ministry of Agriculture, the Ministry of Health, and the Environmental Quality Authority, and its effectiveness in achieving the use of chemicals in agriculture and working to reduce their negative effects.

Through the observations and results that emerged during the audit process, the audit process came to the major conclusion that the weak effectiveness of procedures represented in monitoring the use of agricultural chemicals that it carries out by the relevant parties (the Ministry of Agriculture, the Ministry of Health, the Environmental Quality Authority), as the procedures that were taken in the implementation was not as effective as required to manage the use of agricultural chemicals.

The conclusion was reached through the following:

- The weakness of the effectiveness of the work of the scientific committee in the Ministry of Agriculture was revealed in terms of the lack of a practical protocol that regulates its work, and failure to update the pesticide guide in line with international standards.
- In addition to failure evaluate the traded pesticides would result in the circulation of pesticides in the local market that have been banned from use internationally, as a result of the presence of harmful substances in them.
- Weak coordination between the agricultural directorates and the General Department of Plant Protection and Plant Quarantine regarding the sealing process, which weakens the effectiveness of supervisory procedures in controlling the local market due to the shortcomings in the process of documenting the closing of Agricultural pesticides in circulation and the possibility of some importers circumventing special official procedures in the process of sealing by placing some containers of illegal agricultural pesticides in their warehouses.

Accordingly, the Bureau recommends the following to the relevant authorities:

The need for the Ministry of Agriculture:

- To prepare a practical guide that organizes the work of the Scientific Committee and helps in making decisions regarding agricultural chemicals in a professional and organized manner.
- To conduct a periodic evaluation of the work of the Scientific Committee by its jurisdiction and work tasks and provide recommendations for decision-makers to improve the work of the Scientific Committee.
- To create a database about pesticides traded in the market and pesticides allowed to be imported.
- Effective coordination between the Scientific Committee and the relevant departments in the Ministry of Agriculture to ensure the implementation of its decisions.
- To coordinate effectively with the Environmental Quality Authority to inventory agricultural pesticides seized by the Ministry of Agriculture which are located in its warehouses and the offices of some of its employees, in preparation for the destruction of these pesticides in a safe way to ensure no impact on humans and the environment.

The Ministry of Health must activate its supervisory role regarding the use of agricultural chemicals, in terms of:

- Preparing programs and control plans consistent with its assigned tasks regarding control and inspection of pesticides, and crops, by the necessary instructions and specifications.
- The Ministry must make optimal use of its resources to ensure that it carries out laboratory examination work on the soil and crops.
- Providing the Central Health Laboratory with the necessary human and technical resources to ensure that they examine pesticides and traded crops to ensure their conformity with the Palestinian Specifications and mandatory technical instructions issued in particular.

The Environmental Quality Authority must play its role, in terms of:

- Receiving agricultural seizures periodically from the competent authorities and preserving them in appropriate ways in preparation for destroying them.
- Destroying the seized agricultural pesticides after coordinating with the Ministry of Agriculture to ensure that they are destroyed in safe ways according to Assets.
- Carrying out the supervisory tasks entrusted to them to ensure environmental safety (soil and water), by work plans.

5.2. Challenges and Gaps in the Enforcement of Rules and Regulations

5.2.1. Challenges Which Obstacle Government Institution

In May 2016, representatives from the Arab Group for the Protection of Nature (APN) and PAN Asia Pacific (PANAP) undertook a visit to the Occupied West Bank in Palestine (Watts et. al., 2017). One of the main purposes of this visit was to assess the human rights and environmental implications of the manufacture and illicit trade of pesticides into the Occupied West Bank from inside the Green Line. In this study, through an extensive review of relevant literature regarding the impact of pesticides on humans and the environment in Palestine and adopted policies in existing legislation, several gaps have been identified.

APN and PANAP representatives heard about and witnessed several serious problems relating to agriculture, including:

- The presence of banned highly hazardous pesticides;
- The discharge of raw industrial and domestic sewerage from illegal Israeli settlements in the Occupied West Bank directly onto Palestinian grazing lands and olive groves;
- The dumping of solid waste on Palestinian farmland by Israeli settlers and settlement-affiliated companies;
- The deliberate poisoning and shooting of Palestinian livestock by Israeli settlers and army personnel;
- The expropriation of farmland for Israeli military and other purposes;
- The leaching of chemicals from Israeli industrial and agricultural operations into water resources;

5.2.2. Gaps in Enforcement of Rules and Regulations

A research study on policies regulating agricultural inputs in the West Bank was conducted by ABC Consulting (2020). The main objective of the study was to review current in-place policies regulating the use and trade of agricultural inputs, with a special focus on chemicals and pesticides. The study found the following gaps in the enforcement of the rules and regulations about pesticide marketing:

5.2.2.1. *The Black Market*

Due to the porous nature of the Palestinian market, the lack of monitoring and enforcement of laws, and the complex geopolitical environment of Israel and Palestine, there is a considerable black market for the purchase and sale of fertilizers and pesticides.

Several different types of products are sold in the black market:

- Dual-usage products that are not forbidden in Israel or Israeli settlements;

- Products that have been banned by Israel and recalled in the Israeli market; instead of being disposed of, these products are sold in the black market to Palestinians;
- Products that are globally banned and are smuggled into Israel;

The black market is accessed through local traders who may also run registered stores selling legal products or through individuals with access to these products (i.e. those with Israeli nationality – Palestinians or Jewish Israelis). Although statistics on the amount of smuggled inputs in the market are not available, the MoA noted that suppliers and traders that they have met with estimate that smuggled and cheated inputs account for 60% of inputs in the Palestinian market.

Perspectives on the extent to which the relevant PA ministries and governmental entities are fulfilling their monitoring and inspection role are varied, although the majority of 32 participants of this research believe that the PA is not fully covering its responsibilities to regulate and monitor the use and exchange of pesticides and fertilizers. The main reasons presented for this are the lack of full control of the borders of the West Bank and the gap in authority over Area C.

The most prominent gap identified was that of monitoring traders and preventing smuggled and cheated inputs from entering the market. There are very few regular surprise inspections of agricultural supply stores. Study participants indicated that the black market is not hidden or difficult to access; as one farmer stated, “You can go to most supply stores and if you ask for an illegal product, the trader will ask you to wait. He will go to a storage unit behind his shop and bring back the product you asked for.”

5.2.2.2. Gaps in Israeli Monitoring

The main gaps found in monitoring by Israeli authorities are those related to products that have been recalled in Israel that enter the Palestinian market, and banned pesticides that are still smuggled into Israel.

The Montreal Protocol internationally bans the use of ozone-damaging pesticides, particularly Methyl Bromide (CH₃Br). The use of this pesticide was still common in Israel up until 2013 and it has been recorded that quantities of Methyl Bromide have been moved illegally from Israel to the State of Palestine through Israeli settlements.

The West Bank is often thought of as Israel’s dumping ground, with recalled or expired products coming into the Palestinian market, waste from settlements being marketed to Palestinians as compost and Israeli polluting industries located in the West Bank.

In addition to a lack of monitoring and enforcement of laws, this ‘dumping’ is also made possible in part by the lack of awareness of Palestinian farmers on quality and types of inputs

that are considered hazardous, as well as the low purchasing power of the farmer that forces him/her to buy cheaper inputs, no matter their quality or legality.

5.2.3. Access of Farmers to Agricultural Inputs

Farmers have physical access to a wide variety of fertilizers and pesticides – supply stores are numerous and dispersed throughout the West Bank. Alternatives to banned dual-usage products are widely available in these stores as well. The ease of access to the black market has also increased farmers' abilities to access hazardous and illegal products. The use of pesticides in the West Bank has often been considered excessive in recent years.

5.2.4. Gaps in Pesticide Regulations in Palestine

In this study, through an extensive review of relevant literature regarding the impact of pesticides on humans and the environment in Palestine, and adopted policies in existing legislation, several gaps have been identified.

The fate and impact of pesticide application in the PNA are likely to remain unknown, while the local scientific community is not experienced in conducting the required studies. In addition, the lack of national regulation on pesticide use, prohibition of pesticides placed on the market and use of plant protection products containing certain active substances are outstanding environmental issues.

Accordingly, recommendations to reduce pesticide risk through a combination of reforms at the policy level and its tools, particularly legislation, are proposed:

- To adopt a minimum list of low-risk pesticides supported by a combination of: "prescriptions" based on a comprehensive registration and effective implementation systems.
- A suitable IPM government-supported credit system, traceability systems of agricultural commodities and pesticide containers.
- Pesticide stock management system to reduce the number of obsolete pesticides, and containers recycling system.
- At the same time, global funds should support pesticide alternatives and the enhancement of the developing countries' capacities for pesticide lifecycle management, which is part of a larger global matrix in risk reduction.

It is believed that the current registration/legislation should be updated and post-registration control should be reinforced.

Among the needs was an urgency to intervene at the level of pesticide management: Accordingly, 3 courses of action are needed:

1st: The improvement of food safety and quality of locally produced agricultural commodities, the relevant areas of intervention are suggested as:

- Development of the legislative and operational framework of inspectors and health juridical control and
- Development of a system for contaminants monitoring programs.

2nd: The improvement of the value chains, and there are also 2 areas of interventions:

- Strengthening the management of agricultural inputs and
- Promoting Good Agricultural Practices.

3rd: The increase of the value-added for products of plant origin to improve the good governance and sustainable use of natural resources intervention.

6. Recommendations on Policy, Legislation and Registration Reforms

Farmers are at a high risk of exposure to pesticides directly involved in the handling of pesticides during mixing and spraying pesticides or while working in the treated fields and from residues on food and drinking water. Sometimes due to lack of knowledge farmers face great risks of exposure particularly when they use toxic chemicals that are banned, incorrect method of applications, poorly maintained or inappropriate spraying equipment, and often the reuse of pesticide containers for food storage, poor use of personal protection equipment (PPE) and other safety measures.

Unfortunately, no one document specifies the Palestinian governmental policy on pesticide use. The governmental approach is disclosed through mainly legislation and regulations issued at different levels, be it parliamentary laws, decrees, or ministerial decisions, issued primarily with the objective of pesticide management.

Policy and legislation are practically inseparable. Though legislation is one tool of a policy, a policy cannot be concretized effectively without legislation. At the same time, reforms at the level of legislation are also reforms at the level of the policy. But for our purpose, we will categorize the reforms at the level of the intent as policy, while at the level of practice as legislation reforms. Unquestionably, there is an urgent need to upgrade the existing pesticide legislation and regulations within the context of a clear policy built on the judicial and coordinated use of its tools to amend many of the revealed strategic flaws.

6.1. Suggested Policy Reforms

Following are some of the suggested reforms at the level of the policy. The government should:

- i. Make information and studies about pesticide risk available to the public through specialized sites.
- ii. Adopt one lifecycle management strategy for all types of pesticides: agricultural, public, and industrial.
- iii. Reduce the reliance on pesticides by improving Integrated Pest Management (IPM).
- iv. Promote education and invest in compulsory training for all stakeholders handling pesticides. Going by the principle of “Better knowledge of pesticides will bring better safety performance.

6.2. Suggested Legislation Reforms

6.2.1. Holistic pesticides law:

- A modern holistic national pesticide law needs to be issued to avoid exhaustion of resources due to managing a multitude of pesticide lifecycles depending on pesticide types. This law should be committed to its scope and objectives with the agricultural strategy.
- Update definitions to The International Code of Conduct on pesticide management guidelines on pesticide legislation (FAO/WHO, 2015).
- Should be coherent with the concepts of good agricultural practices (GAP); integrated pest management (IPM) and integrated vector management (IVM) to reduce reliance on pesticides.
- Should be in line with the Ministry of Agriculture Strategy.

6.2.2. Pesticides Scientific Committee

- Creation of a pesticide board which can be an upgrade of the existing pesticide committee. A technical committee of scientists and "implementation committees" in each concerned ministry is to be attached to this board.
- Structurally, the pesticide board should include representatives from several ministries and institutions/ agencies: Agriculture, Public health, Environment, Labor, Industry, Justice, and Customs.
- Functionally, the pesticides board controls the lifecycle of all types of pesticides from import, manufacturing, registration, transport, packaging, labeling, storage, sale, use and disposal by its compelling decisions for all the stakeholders involved.

6.3. Suggested Registration Reforms

The government should include pesticide management as a key factor in its agricultural strategy and adopt the following guidelines:

- i. Stick to the approach of the registration by analogy (FAO/Pesticide Registration Toolkit, 2018) with reference countries, as a general guideline, aiming at a more comprehensive registration system. Registration authorities need to follow up carefully on the changes in pesticide registration in Europe and the world and follow cautiously (using the precautionary principle and the burden of proof) so as not to miss out on technological advancements (The Science Communication Unit, 2018).

- ii. Introduce the concept of “restricted use” pesticides (United States Environmental Protection Agency, 2011) that can be used only by professional certified applicators and are outside the minimum low-risk pesticides list proposed previously.
- iii. Make available alternatives to chemical pesticides by facilitating the registration of biopesticides and natural enemies (Damalas and Koutroubas, 2018).
- iv. Set clear provisions for registration of equivalent pesticide formulations. Developing countries need to register generics or equivalent formulations, due to economic reasons related to decreasing the cost of production and to illegal trafficking of smuggled and counterfeit pesticides (OECD, 1996) when the supply of officially authorized pesticides is short or high in price.

6.4. Suggested Recommendations to be Included in MoA Strategy

1. Crackdown on smuggled and cheated inputs by:
 - Conducting more frequent and geographically diverse unannounced visits to traders;
 - Strengthening customs control specifically on internal roads and entrances to villages;
 - Ensuring transparency and fairness in prosecution of any persons convicted of smuggling or fraud;
 - Promoting media coverage that increases the monitoring of smuggled and cheated inputs.
2. Provide incentives for farmers and traders to buy and sell legal, registered products by:
 - Spreading awareness about the tax returns policy
 - Conducting initiatives to reduce input prices
 - Create an incentives scheme for traders that fully comply with rules/regulations, possibly through a recognition/award system.
3. Fulfill inspection role of chemical residue on fresh produce by conducting regular testing at geographically diverse points of sale.
4. Improve trust between farmers and tax collection agencies by ensuring efficient and quick returns compensating for the value-added taxes placed on regulated inputs.
5. Spread awareness among farmers about the dangers of using banned fertilizers and pesticides and not following the waiting period for permitted pesticides.

7. Conclusions

The Ministry of Agriculture is invited to issue a practical guideline for the use, monitoring and management of pesticides according to the International Code of Conduct on Pesticide Management (FAO/WHO, 2021). (**Annex 6**)

1. *Guidelines on good practice for ground application of pesticides;*

These guidelines are to be prepared to offer practical help and guidance to all those involved in using pesticides for food and fiber production and in public health programs. They have to be drawn up to cover the main terrestrial and aerial spray application techniques.

2. *Guidelines for Personal Protection when Handling and Applying Pesticides:*

These guidelines are intended to guide preventing the risk of pesticides by reducing exposure with the use of effective personal protection, particularly personal protective equipment. The guidelines are to be designed primarily for use by government authorities in charge of pesticide management and risk reduction but may also be useful in sectors such as the pesticide industry, nongovernmental organizations, and other relevant entities.

3. *Guidelines on Licensing of Public Health Pest Control Operators:*

These guidelines are intended to assist governments in implementing a licensing scheme for public health pest control operators (PCOs), as well as to assist the PCO industry in implementing best practices. The objective is to ensure that the pest control industry is orderly, efficient, and protective of people and the environment. The guidelines apply only to PCOs who provide their services in or around premises and public places; they do not cover pest control services in the agriculture and forestry sectors. In addition, the guideline has to reduce pesticide exposure and effect, by using specific safety measures for farm workers to reduce exposure of children and pregnant females.

4. *Guidelines on Management Options for Empty Containers*

These guidelines explain how to design and implement a scheme for managing pesticide containers after the contents have been used. The objective is to ensure that containers are decontaminated as soon as they are empty, that they are not reused in inappropriate ways, and that it is easy for users to return them to the scheme. The guidelines discuss container design, methods for cleaning different types of containers, and disposal options. They explain how a country should go about developing a container management scheme, the information needed to

assess the nature and scale of the issue, the logistics and administration of the scheme and the stakeholders that should be involved.

5. *Guidelines on Organization and Operation of Training Schemes and Certification Procedures for Operators of Pesticide Application Equipment*

These guidelines outline the considerations and options available to countries for regulating the use of pesticide application equipment on farms. The guidelines explain why it is important for countries to have a training and certification scheme for equipment users and they provide a framework that includes: the roles and responsibilities of responsible authorities; an approach to organizing, introducing and sustaining a scheme; the different elements needed; quality assurance; and financing. The guidelines also emphasize that candidates must have general knowledge of pesticides, crop protection, and hazards.

References

1. AGRICULTURE SECTOR STRATEGY “A SHARED VISION” 2011-2013. Agricultural Sector Strategy: A Common Vision (fao.org)<https://faolex.fao.org/docs/pdf/pal167165.pdf>
2. Al-Sa'ed Rashed, Asa'd Ramlawi & Amjad Salah (2011): A national survey on the use of agricultural pesticides in Palestine, *International Journal of Environmental Studies*, 68:4, 519-529. <http://dx.doi.org/10.1080/00207233.2011.608502>.
3. Asghar U, Malik MF, Javed A (2016) Pesticide Exposure and Human Health: A Review. *J Ecosys Ecograph* S5: 005. doi: 10.4172/2157-7625.S5-005.
4. Bashour, I., 2008, Pesticides, fertilizers, and food safety. In: M. Tolba and N. Saab (Eds) Arab Environment: Future Challenges (Beirut, Lebanon: Report of the Arab Forum for Environment and Development (AFED) and Technical Publications), pp. 137–145.
5. Council of Ministers Resolution No. (9) for the year 2012: Pesticides System. 27/2/2013. <http://faolex.fao.org/docs/pdf/pal126498.pdf>
6. Council of Ministers Resolution No. 9 of 2012 on the system of agricultural pesticides. <http://faolex.fao.org/docs/pdf/pal130242.pdf>
7. Damalas, Christos A., Koutroubas, S.D., (2018). Current status and recent developments in biopesticide use. *Agric. For.* 8, 1–6.
8. Enrique MO, Dawn JR, Bielawski M, Norberto C, Posecion JR (2008) A comparison of infant hair, cord blood, and meconium analysis to detect fetal exposure to environmental pesticides. *Environ Res* 106: 277-283.
9. Erin L, Wickerham, Betsy L, Jie S, Niko K, et al. (2012) Reduced birth weight about pesticide mixtures detected in cord blood of full-term infants. *Environ Int* 47: 80-85.
10. Environmental Quality Authority, Palestine (2023). Report on the State of The Environment in Palestine in 2023. Ramallah, Palestine.
11. FAO and WHO. (2021). Managing pesticides in agriculture and public health - A compendium of FAO and WHO guidelines and other resources. 2nd edition. Rome. <https://doi.org/10.4060/cb3179en>
12. FAO/Pesticide Registration Toolkit, (2018). Pesticide Registration Toolkit | Food and Agriculture Organization of the United Nations [WWW document]. <http://www.fao.org/pesticide-registration-toolkit/registration-ools/registration-strategies/registration-by-analogy/en/>.
13. FAO/WHO, (2015). International code of conduct on pesticide management guidelines on pesticide legislation. <https://www.fao.org/pest-and-pesticide-management/pesticide-risk-reduction/code-conduct/en>.
14. Greenpeace-International. Pesticides and Our Health: A Growing Concern; Greenpeace Research Laboratories, School of Biosciences Innovation Centre *Phase 2, Rennes Drive University of Exeter*: Exeter, UK, 2015.

15. Gummin, D.D.; Mowry, J.B.; Spyker, D.A.; Brooks, D.E.; Osterthaler, K.M.; Banner, W. (2017). Annual Report of the American Association of Poison Control Centers. National Poison Data System (NPDS): 35th Annual Report. *Clin. Toxicol.* 2018, 56, 1213–1415.
16. Hamdan Abdul-Jalil; Hazem Bakir; Saad Dager; and Gorge Krzm (2020) “Comparison of Soil Fertility Levels and Pesticide Residues between Chemical and Ecological Agriculture in Wadi Fukin Village” project, implemented by MA’AN Development Center In: Towards Sustainable Agriculture and Sound Management of Solid Waste (2020): Case Studies from Palestine. Reviewed and edited by the Leadership Consultative Center for Sustainable Development. Palestine
17. Husani Murad and Attawneh Medhat (2020). Improving the Farm Producers’ Attitudes in Pesticide Use in the West Bank: Positive Impacts of Applying Good Agricultural Practices” project, implemented by the Land Research Center (LRC). In: Towards Sustainable Agriculture and Sound Management of Solid Waste (2020): Case Studies from Palestine. Reviewed and edited by the Leadership Consultative Center for Sustainable Development. Palestine
18. Israeli Ministry of Agriculture (IMoA), 2008, Plant protection products for organic farming, Annex 7 Israeli Pesticides List-organic farming, Plant Protection and Inspection Services (Israel: Tel Aviv).
19. Issa Yaser, Farid Abu Sham’a, Khaldoun Nijem, Espen Bjetness and Petter Kristensen (2010). Pesticide use and opportunities of exposure among farmers and their families: cross-sectional studies 1998-2006 from Hebron governorate, occupied Palestinian territory. *Environmental Health* 2010, 9:63. <http://www.ehjournal.net/content/9/1/63>
20. Issa Yaser, Hassan Sawalha, Safa Sultan and Bayan Yaghmour (2017). Classification and evaluation of pesticides used in Palestine based on their severity on health and environment. *International Journal of Toxicology and Environmental Health*. Vol. 2(1), pp. 015-026, August, 2017. © www.premierpublishers.org. ISSN: 2167-0449
21. Krzm, George. (2013). February and March this year were the most arid in Palestine 50 years ago! Prospects for Environment and Development.
22. Kumar Rajesh (2020). Human Health and Environmental Effects of Pesticide Use in Agriculture. *International Journal for Research in Applied Science & Engineering Technology* (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429. Volume 8 Issue XII Dec 2020- Available at www.ijraset.com
23. Litchfield, M.H. (2005). Estimates of Acute Pesticide Poisoning In Agricultural Workers In Less Developed Countries. *Toxicol. Rev.* 2005, 24, 271–278.
24. Mahmood, I.; Imadi, S.R.; Shazadi, K.; Gul, A.; Hakeem, K.R. (2018). Effects of Pesticides on Environment; Springer International: Cham, Switzerland, 2016; pp. 253–269.
25. Ministry of Agriculture (2014). The agricultural sector strategy "Steadfastness and development" 2014-2016.

26. Ministry of Agriculture (MoA), 2008, Statistical records (2006/2007) on pesticides use in Palestine. Unpublished report, Ramallah, West Bank, Palestine PCBS. 2010. "The Palestinian environment to where?" Press release, World Environment Day. Palestinian Central Bureau of Statistics. http://www.pcbs.gov.ps/Portals/_pcbs/PressRelease/Envirm-DayE.pdf
27. Ministry of Agriculture. 2009. The Palestinian Agricultural Sector Strategic objectives and priority interventions (General Guidelines). Palestinian National Authority. <http://www.apis.ps/documents/AGR%20PRIOR%20MOA11-05-09-LAST.pdf>
28. OECD, 1996. Report of the OECD-FAO Workshop on Pesticide Risk Reduction. Uppsala, Sweden.
29. Palestinian National Agricultural Extension Strategy 20121. <https://ershad.moa.pna.ps/uploads/file/Extension%20Strategy/Palestinian%20National%20Agricultural%20Extension%20Strategy.pdf>
30. Project Law No. 7 of 1999 on the environment-Palestine. <https://leap.unep.org/en/countries/ps/national-legislation/project-law-no-7-1999-environment>
31. Rashed Al-Sa'ed, Asa'd Ramlawi, Amjad Salah. 2011. A national survey on the use of agricultural pesticides in Palestine. *Int J Environ Studies* 68:4:519-29. Issue 99
32. Regulation No. 9 of 2012 on the system of pesticides in Palestine. [قرار مجلس الوزراء رقم 9 لسنة 2012م بنظام مبيدات الآفات الزراعية \(pna.ps\).](https://www.moj.gov.ps/Portals/0/Regulations/Regulation%20No.%209%20of%202012%20on%20the%20system%20of%20pesticides%20in%20Palestine.pdf) <https://www.moa.pna.ps/uploads/LAWS/202208.html>
33. Report of the National Audit Office on The effectiveness of the procedures of the relevant authorities in controlling the use of Agrochemicals in the Northern Governorates (2021).
34. Research Study Policies Regulating Agricultural Inputs in the West Bank. (2020). <https://www.pafu.ps/uploads/articles/99d0aec51e1e36801603d22815241065.pdf>
35. Rojas A, Ojeda ME, Barraza X (2000). Congenital malformations and pesticide exposure. *Rev Med Chil* 128: 399-404.
36. Rossana B, Anne M, Vinggaard C, Taxvig J, Boberg E, et al. (2013) Levels of pesticides and their metabolites in Wistar rat amniotic fluids and maternal urine upon gestational exposure. *Int J Environ Res Public Health* 10: 2271-2281.
37. Sabarwal, A.; Kumar, K.; Singh, R.P. (2018). Hazardous effects of chemical pesticides on human health and other associated disorders. *Environ. Toxicol Pharm.* 63, 103–114.
38. Sabrina L, Lidia C, Loreto S, Marina M, Estarlich (2012) Prenatal and postnatal residential usage of insecticides in a multicenter birth cohort in Spain. *Science of the Total Environment* 273: 445-446.
39. Safi, J.M., Ed-Nahhal, Y.Z., Soliman, S.A. and El-Sebae, A.H., 1993, Mutagenic and carcinogenic pesticides used in the agricultural environment of Gaza Strip. *Science of the Total Environment*, 132, 371–380.

40. Sawalha, H. (2012). Misuse of pesticides by vegetable farmers in Palestinian territories and recommendations for their proper use. *IUG J Nat Eng Stud* 20:41-54.
41. Tessema, R.A.; Nagy, K.; Ádám, B. (2021) Pesticide Use, Perceived Health Risks and Management in Ethiopia and in Hungary: A Comparative Analysis. *Int. J. Environ. Res. Public Health* 2021, 18, 10431. <https://doi.org/10.3390/ijerph181910431>.
42. The State of Palestine, Ministry of Agriculture (2016). National Agricultural Sector Strategy (2017-2022), “Resilience and Sustainable Development”1. <https://faolex.fao.org/docs/pdf/pal174456E.pdf>
43. The Law on Agriculture No. (2) of 2003 in Palestine. [The Law on Agriculture \(pipa.ps\)](#)
44. Towards Sustainable Agriculture and Sound Management of Solid Waste (2020): Case Studies from Palestine. Reviewed and edited by the Leadership Consultative Center for Sustainable Development. Palestine.
45. United States Environmental Protection Agency, (2011). Pesticides Classified for Restricted Use. U.S.C, USA.
46. United States Environmental Protection Agency, (2018). Public Participation Process for Registration Actions [WWW Document]. In: <https://www.epa.gov/pesticide-registration/public-participation-process-registration-actions>.
47. Watts, M, Lee T, and Aidy H. (2017). Pesticides and Agroecology in the Occupied West Bank. <http://library.ipamglobal.org/jspui/handle/ipamlibrary/890>.
48. Watts, M, Lee T, and Aidy H. (2017). Pesticides and Agroecology in the Occupied West Bank. <http://library.ipamglobal.org/jspui/handle/ipamlibrary/890>
49. Wohlfahrt VC, Katharina M, Main I, Schmidt M, Malene B, et al. (2010) Lower birth weight and increased body fat at school age in children prenatally exposed to modern pesticides: a prospective study. *Environ Health* 10: 79.
50. Yacoub, B. (2003). Application and usage of pesticides in Palestine: Current and Future Outlook. *An-Najah Univ. J. Res. (N. Sc)* 17:90-98.
51. Youn K, Shim S, Mlynarek P, Wijngaarden N (2009) Parental exposure to pesticides and childhood brain cancer: U.S. Atlantic coast childhood brain cancer study. *Environ Health Perspect* 117: 1002-1006.
52. Zyoud, S. H., Sawalha, A. F., Sweileh, W. M., Awang, R., Al-Khalil, S. I., Al-Jabi, S. W., & Bsharat, N. M. (2010). Knowledge and practices of pesticide use among farm workers in the West Bank, Palestine: safety implications. *Environmental Health and Preventive Medicine*,15(4): pp. 252–261.

Annexes

Annex 1: FAO/WHO, (2015). International code of conduct on pesticide management guidelines on pesticide legislation. <https://www.fao.org/pest-and-pesticide-management/pesticide-risk-reduction/code-conduct/en>

Annex 2: The Law on Agriculture No. (2) of 2003 in Palestine: [The Law on Agriculture \(pipa.ps\)](#)

Annex 3: The list of registered pesticides in Palestine (2022). (**Attached Suggested File**)

Annex 4: Regulation No. 9 of 2012 on the system of pesticides in Palestine:
<http://faolex.fao.org/docs/pdf/pal130242.pdf>

Annex 5: Council of Ministers Resolution No. 9 of 2012 on the system of agricultural pesticides:
<http://faolex.fao.org/docs/pdf/pal130242.pdf>

Annex 6: FAO/Pesticide Registration Toolkit, (2018). Pesticide Registration Toolkit | Food and Agriculture Organization of the United Nations [WWW document].
<http://www.fao.org/pesticide-registration-toolkit/registration-ools/registration-strategies/registration-by-analogy/en/>.