



## Research Article

# Assessment of the Status of Obsolete Pesticide Stocks in Selected Parts of Ethiopia

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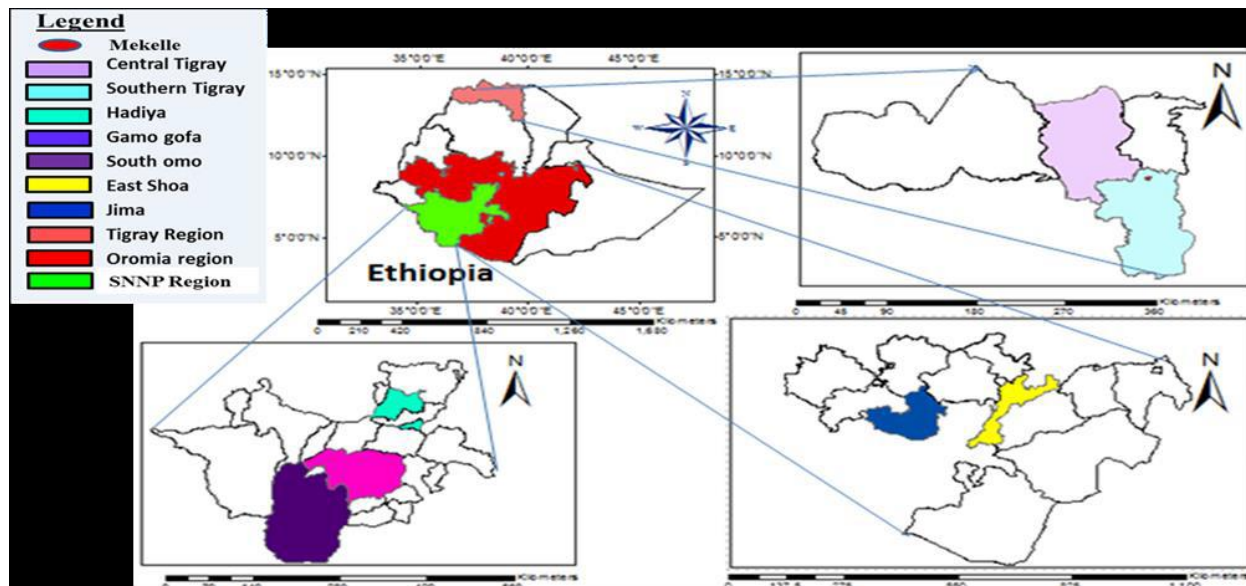
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### Abstract

Ethiopia like most sub-Saharan countries had been suffered by obsolete pesticides accumulated at various places across the country. Disposal of obsolete pesticides in Ethiopia had been inadequate and presently huge quantities of obsolete pesticide stocks are found accumulated in substandard stores owned by ministry of health, ministry of agriculture and various investors, presenting potential risks to nearby residents and the environment. This assessment study of obsolete pesticide stocks' status was aimed at evaluating the status and effects of obsolete pesticide stocks on public health and the environment and indicate a corrective action. The methodology employed to collect data was field observation, interviews and questionnaires dispatched to study site residents. Results of the study indicated that obsolete pesticide stocks were depreciated, kept in torn out drums, burst open sacks, indiscriminately mixed up with other chemicals, exposed to sunlight, wind drift and runoff water and easily accessible to animals and humans. Thus obsolete pesticide stocks accumulated in inefficiently secured stores could be a threat not only to public health and the environment but also to the fast growing economy of the country. Awareness raising and training given to the public on the dangers involved with obsolete pesticide stocks was inadequate. To aware the community and conduct further research to ascertain the actual situation of obsolete pesticide stocks accumulated across the country need to be carried out before the present situation causes more social and environmental problems.

The economy of developing countries is agriculture dependent and used pesticides to protect pests against insects, fungi, weeds as well as to increase agricultural yields. Ethiopia with a population of about 97 million is dependent on agriculture for food and other basic necessities. Pesticide use in Ethiopia began in the 1940's and its use increased steadily with developments in increased food production and expansion in floriculture. Pesticides become obsolete with the passage of time and lost their efficacy to be used for their intended original purpose and therefore require disposal [1,2]. Ethiopia has accumulated obsolete pesticide stocks due to prolonged storage of pesticides, inadequate control over pesticide importation, inappropriate storage conditions because of poor storage facilities and lack of monitoring system for

pesticide use in the country [3]. However, Chemical pesticides, regardless of their hazard, are used intensively in the fast changing agricultural sector of the country [4,5]. Stockpiles of obsolete pesticides are in a deteriorated condition, poorly stored and located close to agricultural fields, housing and water supplies, causing unavoidable risks to human health, ground and surface water and the environment. The impact of obsolete pesticides is greatest on disadvantaged people who scavenge for empty pesticide containers which are used for carrying food, water, etc. with little awareness of the dangers involved [6]. Pesticides stored in unsafe places run off into ground and surface water, exposing entire populations to chronic and acute health risks. Many pesticides persist in the environment, are often transferred



**Figure 1:** Study area Map.

long distances from their original area of storage, and are detected in human tissues and are transferred across the placenta via breast milk to children [7,8]. Children exposed to a variety of pesticides develop cancer and Parkinson's disease as well as asthma, allergy, diabetes and obesity increased risk [9,10]. Obsolete pesticide stocks not only present a hazard to public health but also contaminate natural resources and stand in the way of socio-economic development [11]. The stocks in the study areas were in bad condition with leaking drums; burst open sucks and stores themselves in bad state posing threat to human health and the environment [12].

## Materials and Method

### Site description and data collection period

This study was conducted in the regional states of Tigray, Oromia and south Ethiopia. In Tigray regional state data was collected from southern zone (Alamata woreda), central zone (Axum) and mekelle zone at mekelle city. From Oromia region, East shoa zone, Boset, Adama, Dugda, Adamitulu and Bora woredas were selected to collect the required data. In Jima zone, also in Oromia regional state, the study was conducted at metu/soro and Bedele/ Doro Manekia (2 sites) towns. In southern regional state, the study was carried out at Bena Tesmay, Arbaminch and M/bedewach cities of South omo zone, Gamo Gofa zone and Hadiya zone respectively. The data was collected from September 2016 to January, 2017 G C.

### Method

Investigators from environment and forest research centers together with agriculture and natural resources experts from the four research areas were participated in the data collection. Three regional states (Tigray, Oromia, and South Ethiopia) were selected for study based on the availability of research facilities and access to the pesticide storage sites. Pesticide stores from each region were also selected on the basis of obsolete pesticides overstocking, duration of pesticides accumulation, and condition of storages and vulnerability of nearby residents to pesticides exposure by first inspecting the stocks in the stores by field visit. An interview with expertise and residents living close to the storage sites was also used to collect data in addition to questionnaires and on site observation. All individuals who lived within less than 0.5 kilometers distance from the pesticide stores were

used as source population and fourteen old and poorly secured obsolete pesticide stores were chosen purposely from the selected regional states for the study.

### Data collection tools

A questionnaire was developed by referring different literatures and modified according to the objectives of this study. The questionnaire was used to gather information from study area residents about the status of obsolete pesticide stocks and their knowledge on effects of pesticides on human health and the environment. The questionnaire was developed in English but later translated verbally into the languages of respondents by data collectors. Field observation and interviews were also used to collect data. Prior to using the questionnaires for data collection, data collectors (with B.SC degrees) were familiarized with the issues and contents addressed in the questionnaire, ethical considerations, and on data collection procedures.

## Results

### Socio - demographic characteristics of respondents

422(100%) households were participated in the survey. 254(60.2%) of them were male and 168(39.8%) female. Education, 42(10%) participants were illiterates, 119 (28.2%) could read and write, 67(15.8%) were grades 1-8th, 93(22%) were grades 9th-12th, 25(5.9%) had certificates, 31 (7.3%) were with diploma and 45(10.7%) had a university degree. The mean age of participants was 35 with a minimum of 18 years and a maximum of 75 years. 100 (23.7%) participants were farmers, 76(18.0%) students, 88(20.9%) civil servants and 158(37.4%) with different jobs including merchants, house wives and daily laborers (Table: 1).

### Status of obsolete pesticide stocks

Obsolete pesticide stocks accumulated in the study area storages were deteriorated and exposed to animals, humans and external damaging conditions like rain and floods. The stores themselves were badly facilitated, with ragged tin sheet walls and roofs leaking obsolete pesticide stocks to nearby areas contaminating natural resources upon which the life of nearby residents depended on. Obsolete pesticide stocks were kept in the stores since the military (dergu) regime in solid and liquid forms and were placed amassed with other chemicals in a manner difficult to separate one from the other. Obsolete pesticide

Background	Respondents [N]	Percent [%]
<b>Sex</b>		
Male [M]	254	60.19
Female [F]	168	39.81
<b>Occupation</b>		
Farmer	100	23.7
Students	76	18
Civil servants	88	20.8
Merchants	10	2.4
Ot House wives, Laborers	148	35.1
<b>Education level</b>		
Illiterate	42	9.95
Read and write	119	28.19
Elementary[grade1-8]	67	15.87
Secondary [grade 9-12]	93	22.03
Certificate	25	5.92
Diploma	31	7.3
University degree	45	10.66

**Table 1:** Socio-demographic characteristics of respondents.

stocks were also placed in leaking metal drums, wooden boxes and burst open sacks with no labeling. Obsolete pesticides were seen spilled over the floors of some stores by nearby residents for taking out pesticide containers without adequate precaution on effects of pesticides. The stocks accumulated in each of the study area stores as indicated by agriculture offices of Ethiopia, were supplied by the government for the control of migratory pests like locust, army worms and other pest outbreaks. Storekeepers, without protective clothing were responsible to safeguard the pesticide stocks and none of them had received trainings on impacts of pesticides. In some cases obsolete pesticide stores were used as permanent offices for storekeepers and are likely exposed to pesticide hazards (**Figures 1 and 2**).



**Figure 2:** Obsolete Pesticides stored mixed with office utilities.



**Figure 2:** Storekeepers exposure to obsolete pesticide stockpiles.

### Perception of participants to obsolete pesticides and their impacts

The Perception of study site participants on obsolete pesticides and their effects was inadequate. 115 (27.3%) respondents used chemical pesticides and empty pesticide containers from the stores without any protective equipment for domestic and agricultural use purposes. 79 (68.7%) of those who used chemical pesticides and empty pesticide containers used safety tools like hand gloves (35.44%), boots (21.52%) and mouth muffs (43.04%) during application and the rest 36 (31.3%) failed to use safety tools because of lack of safety tools (63.70%) and lack of awareness (36.29%). Regarding to the adverse effects of obsolete pesticides on health and environment, 238 (56.4%) respondents heard about the harmful effects of obsolete pesticides and 184 (43.6%) indicated that they did not have any knowledge on the impacts of pesticides on health and environment. When participants were asked if they took training on effects of obsolete pesticides on health and environment, 264 (62.6%) participants replied that they took no training on pesticide effects and 64 (15.2%) others said that they did not remember whether or not they took training. Disposal practices of obsolete and unused pesticide stocks was done by burning (25.6%), by burying in the soil (23.7%), by dumping on open spaces (33.9%) as was indicated by 351 participants and (16.8%) did not know how and where to dispose of unused and obsolete pesticides, which is a clear indication of the low awareness and inadequate training of study site residents on the practices and harmful impacts of pesticides (Table 2).

### Pesticide use and environmental effects

As indicated in table 2, above, the study result showed that 171 (40.5%) participants perceived pesticides as useful and used them nearly always (31.0%), each year (33.9%), and rainy seasons (35.1%). It was also understood that obsolete pesticide stocks accumulated in the stores affect human beings, animals and the environment (air, water, soil) as indicated by 161, 45 and 188 study area participants respectively. Regarding to the major effects associated with storage of obsolete pesticides and leakages from the stores, 138 (32.7%) respondents said bad odor, 17 (4.0%) health problems, 148 (35.1%) air, water and soil quality decline and 119 (28.2%) participants indicate damage to all segments of the environment. Thus obsolete pesticide stocks accumulated in the study areas are likely to expose residents to hazardous health and environmental impacts if the current situation is abandoned to its present state.

### Discussion

The study showed that obsolete pesticide stocks were accumulated in stores located inside residential areas. The stocks were stored mixed up with several expired office materials in leaking and unlabeled containers. The stocks were exposed to high temperature fluctuations



<b>Do you know the harmful impacts of/obsolete/ pesticides?</b>	Yes [%]	No [%]	I donot know	
	238 (56.4)	180 (42.6)	4 90.9)	
<b>Were there any health problems from obsolete pesticide stores or use of pesticide chemicals and empty pesticide containers?</b>	Yes [%]	No [%]	I donot know	
	83 (19.7)	308 (73.0)	31 (7.3)	
<b>Who are most affected by obsolete pesticide chemicals stocks in the stores?</b>	Humans (%)	Environment (%)	Animals (%)	All (%)
	161 (38.2)	91 (21.5)	45 (10.7)	125 (29.6)
<b>What are the major problems associated with stored obsolete pesticide stocks nearby?</b>	Odor (%)	Illness (%)	Environmental pollution (%)	All (%)
	161 (38.2)	91 (21.5)	45 (10.7)	125 (29.6)
<b>Was there any accident occurred due to obsolete pesticide chemical storages?</b>	Yes (%)	No (%)	I do not remember (%)	
	105 (24.9)	309 (73.2)	8 (1.9)	
<b>Have you ever had any complaint on the problems of obsolete pesticide stores?</b>	Yes (%)	No (%)	No respond (%)	
	190 (45)	213 (50.5)	19 (4.5)	
<b>Which part of the environment is highly polluted by obsolete pesticide stocks near to you?</b>	Soil (%)	Water (%)	Air (%)	I do not know (%)
	50 (11.8)	22 (5.2)	268 (63.5)	82 (19.4)
<b>How are obsolete and unused pesticide stocks disposed of?</b>	Burning (%)	Burying (%)	Open space disposal (%)	No response (%)
	108 (25.6)	100 (23.7)	143 (33.9)	71 (16.8)
<b>What type of problems did leakages from obsolete pesticide stores caused to you?</b>	Bad odor (%)	Vomiting, Headache, Skin irritation (%)	Water, soil (%)	All indicated (%)
	138 (32.7)	17 (4)	148 (35.1)	115 (28.2)
<b>Were there any training given to you on the effects of obsolete pesticide stocks?</b>	Yes (%)	No (%)	I do not remember (%)	No response (%)
	94 (22.3)	264 (62.5)	62 (14.7)	2 (0.5)
<b>Were (are) pesticide stocks beneficial to you?</b>	Yes (%)	No (%)	I do not know (%)	
	171 (40.5)	229 (54.3)	22 (5.2)	
<b>Is there any liquid leakage from obsolete pesticide stores?</b>	Yes (%)	No (%)	I do not know (%)	
	62 (14.7)	334 (79.1)	26 (6.2)	
<b>Where did leakages from obsolete pesticide stores end up?</b>	Open land (%)	Rivers/stream (%)	Farm land (%)	
	33 (53.2)	12 (19.4)	17 (27.4)	

Table 2: Response of participants to questionnaires.

and many damaging factors. Many of the obsolete pesticide stores were assembled from wood, mud and tattered tin sheet walls allowing people to easily enter into to snatch chemicals and recyclable empty pesticide containers. Respondents from the Study area (27.3%) used chemical pesticides and empty pesticide containers for control of insects and grain borers with little awareness about the dangers of pesticides. Of those participants (27.3%) who used chemical pesticides and empty pesticide containers 44(38.26%) used chemical pesticides, 28(24.3%) pesticide containers and 43(37.4%) both chemical pesticides and empty pesticide containers. The use of safety tools by participants during pesticides application was minimum (18.7%), showing users risks to pesticide exposure. 238 (56.4%) participants indicated to have heard about the effects of obsolete pesticides on health and environment but did not practice any safe way use of pesticides and their containers. Only 94 (22.3%) participants took training on effects of pesticides

while the majority (77.7%) was incapable to receive training. This situation was clear enough to indicate the low level awareness of residents in the study areas. Another indicator of lack of awareness was also shown by 351 (83.2%) respondents who disposed off obsolete pesticides by burning, burying in the soil and by dumping on available open spaces. The use of protective equipment by the respondents in the study areas was little (18.7%) even though 19.7% of the respondents indicated that they felt different health problems related to pesticides and empty pesticide containers use. The accumulation and haphazard use of obsolete pesticide stocks and empty pesticide containers not only present hazard to public health but could also contaminate nearby soil, ground and surface water resources. The problem of obsolete pesticide stocks in the study areas was high that need urgent action to fully identify, secure or dispose off existing stocks as well as to prevent further accumulation of new ones.



## Conclusion

Obsolete pesticide stocks were in a bad condition, stored in unsafe place close to residents, uncontrolled and unprotected, stocked with other utilities, exposed to animals, humans and easily reaching to the immediate surrounding through several agents like wind drift and runoff water. Obsolete pesticides and empty pesticide containers were haphazardly used by the residents without any protective equipment. The awareness level (linked to training) of the research area residents was inadequate. Disposal of obsolete and banned pesticides practice was environmental unfriendly. Stench odor, illness and water and soil quality degradation related to obsolete pesticides is a serious problem for the residents living close to the study area storage sites. Obsolete pesticide stores were poorly facilitated with ragged walls and roofs letting in light and rain that speeded up the deterioration of pesticides inside the stores. Obsolete pesticides stored in unsafe and uncontrolled stores leak off into ground and surface water and disperse into the air exposing entire populations with unavoidable health risks. Residents in the research areas are also exposed to obsolete pesticide hazards through the food and water they used and the air they breathe from the immediate contaminated environment.

## Recommendation

An effort made to dispose obsolete pesticides accumulated across the country was almost none except that done in 2003 by FAO in collaboration with ministry of agriculture. But pesticides are entering into the country each year without proper inspection and control, aggravating the existing situation. Negative effects of obsolete pesticide stocks in the study area are expected to be high even though removal of out-dated stocks is far-off due to limited technical resources and the high cost involved. Therefore:

1. Further research to ascertain the actual quantity and situation of obsolete pesticide stocks across the country is required.
2. Pesticide Stocks should be collected, sorted and removed to a place far from urban and rural residents.
3. Procure quantities of pesticides that could be used in one year and avoid purchase of pesticides than needed during pest out breaks.
4. Make demand driven planning of pesticide requirement for each agricultural areas and seasons.
5. Raise public awareness on risks of pesticides on health and the environment.
6. Establish an entity that controls importation, distribution and application of pesticides in the country.

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