

E-ISSN: 2708-0021
P-ISSN: 2708-0013
www.actajournal.com
AEZ 2021; 2(1): 47-54
Received: 22-11-2020
Accepted: 24-12-2020

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Knowledge of pesticides and health risk associated with their use against pests of vegetable crops in the Tahoua region in Niger

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DOI: <https://doi.org/10.33545/27080013.2021.v2.i1a.30>

Abstract

The present study consists in evaluating the peasant practices of using pesticides on vegetable crops. To do this, an interview guide is developed and administered to market gardeners. This guide made it possible to collect the necessary data on pesticides and the practices of their use by producers. Analysis of the results obtained made it possible to identify 17 pesticides used by producers represented by seven (7) chemical families, of which only 11.76% are approved by the Sahelian Pesticides Council (CSP). Insecticides and herbicides dominate with eight (8) products each and one insecticide-acaricide. The interval between treatments varies from 5 to 14 days depending on the operator. The producers observe a delay of less than 24 hours before returning to the plots after a treatment. When spraying 60 to 70% carry out the treatment without any personal protection means and 28.60% use unsuitable means of protection such as (turbans, scarves and sachets). The results of the survey show that 73, 80% of producers are unaware of the risks of using chemical inputs. Most of the producers are victims of poisoning cases, including 30% colds, 21% headaches, 5% dizziness and 2% vomiting. These results are a good indicator from a perspective of preserving producers, consumers and the environment against the harmful effects of pesticides.

Keywords: pesticides, pests, farming practices, market gardening, Tahoua

1. Introduction

The market gardening sector is experiencing trends for the evolution of production data, use of inputs and contributes significantly to food at the national level. It can experience significant economic growth thanks to exports (Madou *et al* 2001). The phytosanitary products used in agriculture belong to different chemical families and thus have various properties (Amadou, 2014). The majority of pesticides purchased from unauthorized dealers are not recommended for market gardening. Previous studies report skin irritation, headache, cough, dizziness, breathing problems, fatigue, diarrhea, etc. (Soro *et al.* 2019) ^[10]. Pesticides are among the most dangerous pollutants in the environment due to their stability, mobility, and long-term effects on living organisms (Ais and Ousmane, 2018) ^[11].

Several producers carry out their activities without taking into account the preservation of the environment and the health of consumers (Doumbia *et al.* 2009) ^[6]. The rural commune of Tabalak located in the department of Abalak, Tahoua region, is an area of high onion and tomato production. The latter faces a strong use of synthetic chemical pesticides to control pests and weeds to boost yield. The use of chemical inputs requires knowledge to ensure compliance with the rules of good practice. The improper practice of chemical inputs can create a serious problem for the health of producers and the environment. It is therefore important to know the pesticides used and the practices of producers in this region with a high market garden production.

2. Materials and Methods

2.1 Presentation of the study area

The rural commune of Tabalak (figure 1) is located between 005.66456 ° and 005.88120 ° East longitude, 15.11140 ° and 15.18371 ° North latitude. It is located in the department of Abalak, region of Tahoua. The capital of the Commune is Tabalak and is located fifty (50 km) kilometers east of Tahoua (capital of the region) 85 km west of ABALAK (capital of the department). It is one of the five (5) communes of the department of Abalak (Abalak, Akoubounou, Azeye, Tabalak, and Tamaya).

It is bounded to the north by the rural communes of Kao and Barmou to the east by the commune of Akoubounou, to the

south by the commune of Keita and to the west by the commune of Kalfou (PDC, 2015).

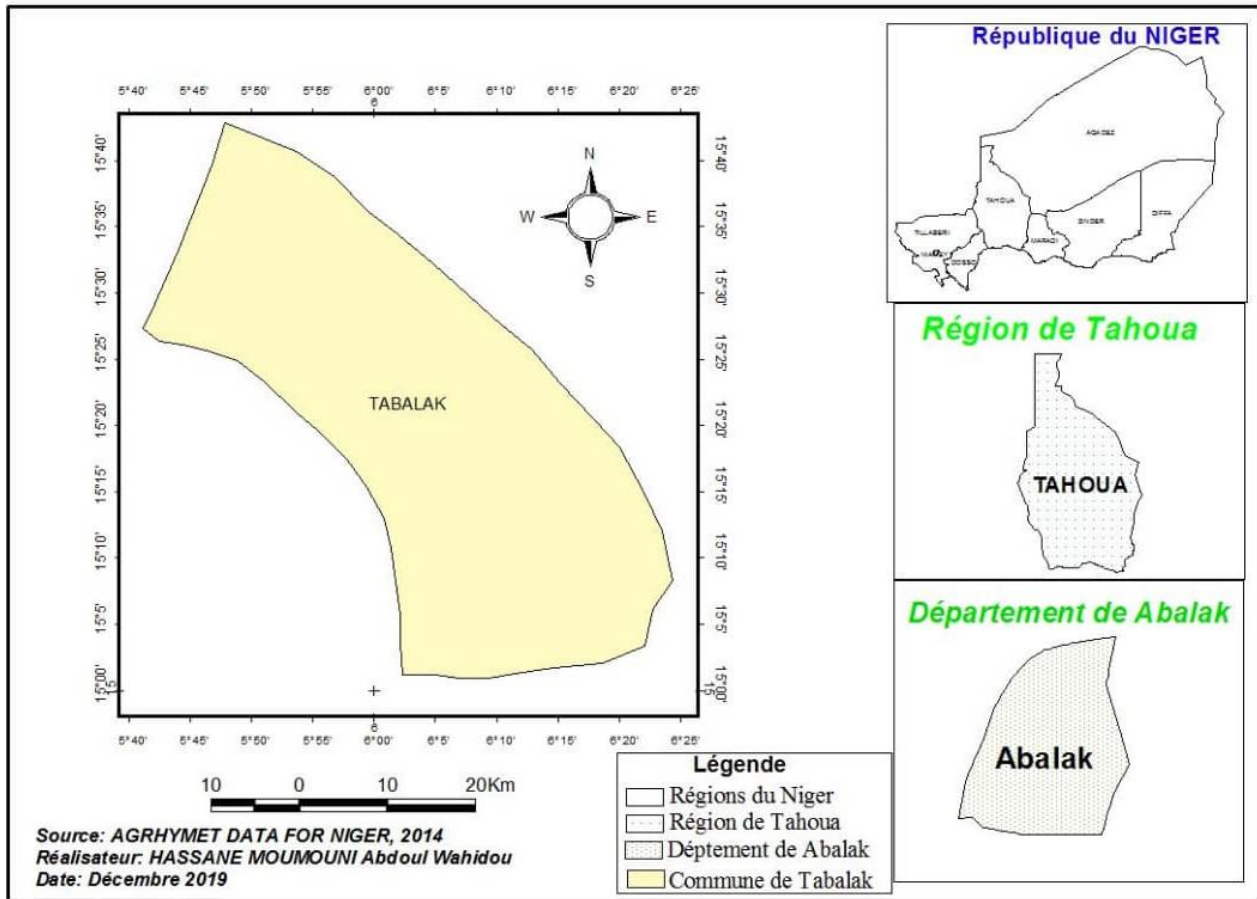


Fig 1: Map of the municipality of Tabalak

2.2 Maintenance guide

The data collection tools administered to market gardeners are individual files. These sheets consist of open questions relating to the different types of pesticides, their origins, use practices, trade names, etc. Other information such as the active ingredient of each product listed and its origin were collected from local pesticide vendors in the commune of Tabalak and its surroundings (Ville de Tahoua).

2.3 Sampling

In this study, a semi-reasoned sampling was carried out. It consists of targeting producers with at least two plots in the pond. A total of 100 producers were reasonably chosen. These producers represent the various associations of producers at the commune level and all practice market gardening in the Tabalak pond.

2.4 Data processing and analysis

The first step consisted in entering the data collected from each person surveyed in Excel version 2017. The data collected was subsequently cleaned and submitted for analysis using SPSS software. This software is used for data analysis, including frequency analysis, descriptive analysis, and cross-tabulation. The chi-square test is done to compare the qualitative variables. Quantitative variables are

subjected to a t test of independence to compare means. The significance level is estimated at 5%. Excel 2010 software is used to make charts.

After all these processes, the various pesticides identified were compared to the list of pesticides authorized in CILSS countries including Niger (CSP: Sahelian Pesticides Committee). This comparison made it possible to identify authorized and unauthorized pesticides. Subsequently, the different active ingredients of each identified products were analyzed which will make it possible to identify those which are identical and therefore identical pesticides.

3. Results

3.1 Diversity of pesticides used by producers

The results shown in Table 1 present the list of pesticides identified by producers. A total of 17 pesticides were listed including 8 insecticides, 8 herbicides, 1 insecticide-acaricide. These pesticides contain 9 different active ingredients which are: Acetapimirade, Cypermethrin, Profenos, Cypermethrin, Lamdachyhalothrin, Permethrin, Oxyfluorfen, Glyphosate; Pendimethalin and Abamectin. More than 88.24% of pesticides are not registered against 11.76% of registered pesticides. The latter are Acarus and Capt 88 EC.

Table 1: List of pesticides identified by producers

Active ingredient	pesticide name	Chemical family	Pesticide type	Danger class by WHO
Abamectin	ACARUIS	Avermectine	Insecticide acaricide	II
Abamectin 18 EC	ABAMET	Avermectine	Insecticide	II
Acetamiprid / I + cypermethrin	CAPT 88 EC	Néonicotinoïde+Pyréthroïde	Insecticide	II
Lambda Cyhalothrin 25g l	COTOFAN	Pyrethroïde	Insecticide	II
Glyphosate	FORCE UP	Organophosphorus	Herbicide	III
Glyphosate	GLYCEL	Organophosphorus	Herbicide	III
Oxifluorfen	GOAL 4 F	Diphénylethers	Herbicide	II
Lambacyhalothrin	LAMDOR 25 EC	Pyrethroïde	Insecticide	II
Pendimethalin 33% EC	MISSILE	Dinitroaline	Herbicide	II
Chlorpyrifos 20%	PERFECT KILLER	Organochlorines + Organophosphorus	Insecticide	II
Pendimethalin 33% EC	PENDANT 33 EC	Dinitroaline	Herbicide	II
Pendimethalin 50% EC	PENDI SHI	Dinitroaline	Herbicide	II
Permethrin 0,6	RAMBO	Pyrethroïde	Insecticide	II
Glyphosate	ROUND UP	Organophosphorus	Herbicide	III
Profenofos40%+cypermethrin	SHARP SHOTER	Organophosphorus +Pyrethrinode	Insecticide	II
Oxyfluorfen12%	OXYFEN	Diphénylethers	Herbicide	III
Abamectin	VOMECTINE	Avermectine	Insecticide	II

3.2 Breakdown of pesticides according to chemical families

Figure 1 shows the distribution of the different chemical families of pesticides. 17.64% belong to the family of

(organophosphates, avermectins, diphenyethers, dinitoaline) and 11.64% to others (organosphorus + pyrethrinoid, organocholor + organophosphorus)

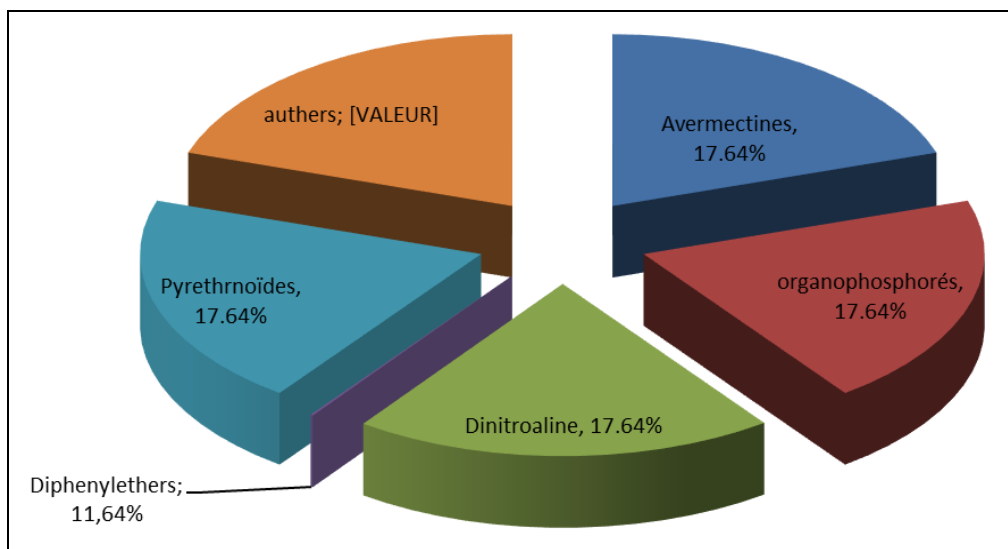


Fig 1: Distribution of the different chemical families of pesticides

3.3. Frequency of use of herbicides according to producers

There are two ways to apply herbicides. The first by the use of total herbicides before transplanting and the second by selective herbicides after transplanting. Before transplanting, the pesticides used are: glycel, force up;

Round up. The second application is a post-emergence treatment. This is Goal 4f, pendis hi; missile, oxyfen which are selective herbicides. Figure 2 shows the frequency of herbicide use. Force up and glycel are the most widely used herbicides which are respectively 26% to 53%.

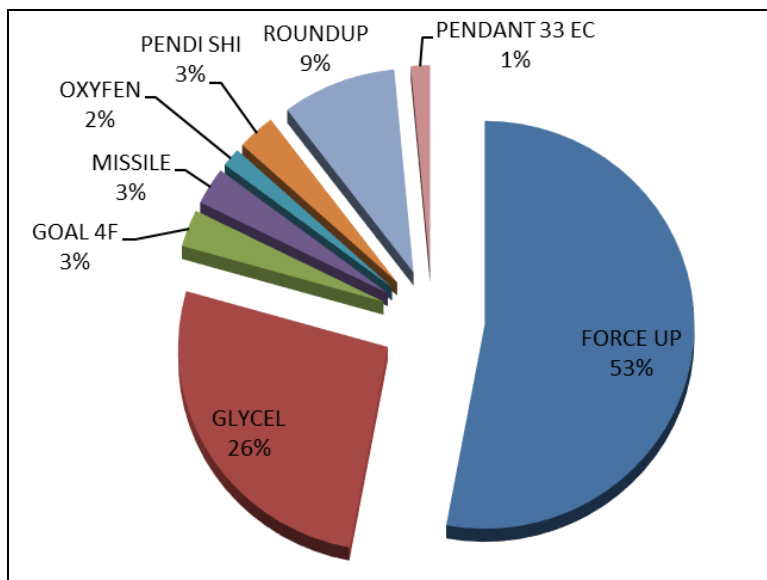


Fig 2: Frequency of herbicide use according to producers

3.4 Doses of herbicides applied by producers

The analysis in Table 2 shows the doses of the herbicides used by producers in underdose and overdose. An overdose is used with the following herbicides: force up, glycel, pendi shi, Roundup, Pendant 33EC. The dose of glycel is 3 times

higher than the dose prescribed by the manufacturer (i.e. 9 vials per hectare). For Force up, the dose is 2 times higher than the dose recommended by the manufacturer (i.e. 6 bottles per hectare). An under dosage was noticed at the level of Goal 4f, Missile and Oxyfen herbicides.

Table 2: Comparison between the dose used and the manufacturer's dose

Pesticide name	Dose per hectare in l	Manufacturer dose
Force Up	+7,5	3
Glycel	+9,34	3
Goal 4f	-0,26	0,5
Missile	-1,37	1,75
Oxyfen	-0,22	0,5
Pendi Shi	+3,08	1,75
Roundup	+3,95	3
Pendant 33 Ec	+8,59	1,75

+ = on dosage
 - = under dosage

3.5 Proportion of pesticide use according to producers

Figure 3 shows the different insecticides used by producers. Sharp shooter and Lamda 25 EC are the most widely used,

accounting for 60 to 12% of insecticides. Abamect, Acaruis, Vomectin are the insecticides which are seldom used. Rambo is a household insecticide used by 5% of growers.

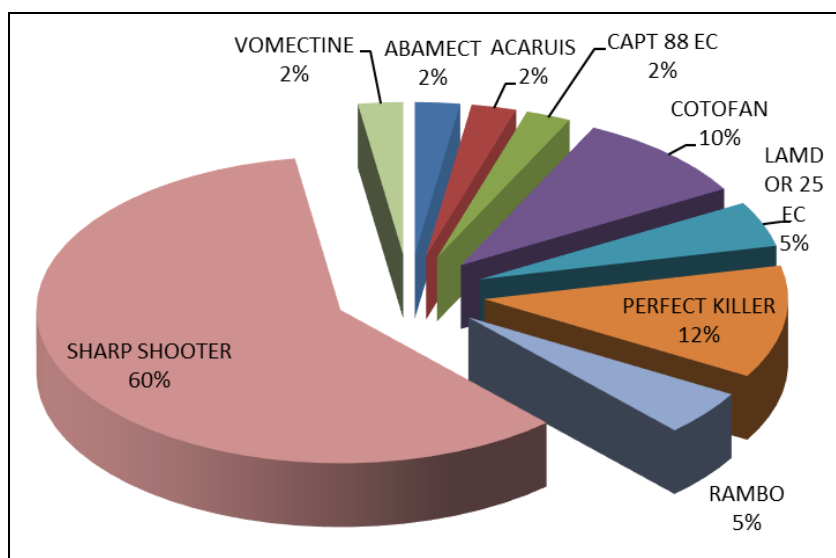


Fig 3: Frequency of insecticide use according to producers

3.6 Comparison of insecticide doses

The results of Table 3 show the insecticides used in overdose and underdose. From the analysis of Table 3, it appears that the insecticides used by overdose producers are

twice the manufacturer's dose. Acarus; CAPt 88EC are the most used in overdose, ie 2 bottles per hectare. Insecticides used in under dosage are 2 to 3 times lower than the manufacturer's dose.

Table 3: Comparison between the Dose of insecticides used and the commercial dose

Pesticide name	Dose per hectar	Manufacturer dose
Abamect	-473,17	1000
Acaruis	+2610,42	1000
Capt 88 Ec	+10050,25	500
Cotofan	-382,75	800
Lamdor 25 Ec	-263,86	800
Perfect Killer	-458,95	1250
Rambo		
Sharp Shooter	-532,18	1250
Vomectine	-473,17	1000

+ = on dosage
 - = under dosage

3.7 Interval between treatments according to producers

The treatment interval is the time between the application of one pesticide to another on the same crops. This interval is applied differently by growers as shown in Figure 4. For onion and tomato, they vary from 5 to 14 days. Producers

using a 7-day interval account for 80% for onion and 51.2% for tomato. The shortest interval is 5 days. The latter is applied by 22% of onion growers and 20% for those who grow tomato.

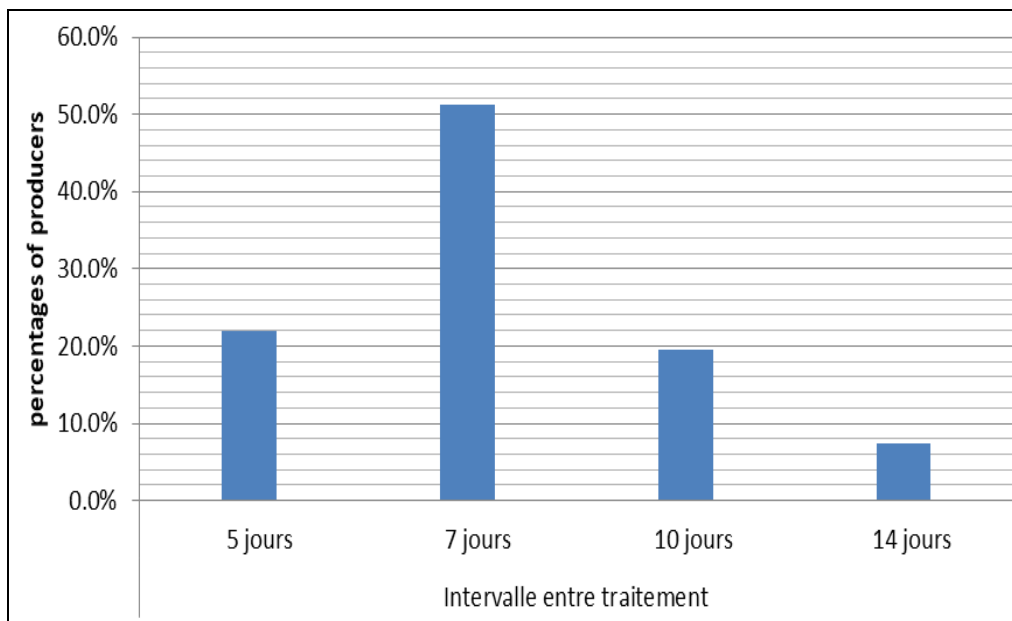


Fig 4: Interval between treatments depending on the crop

3.8 Processing time

The application of pesticides requires consideration of the direction of the wind. The results of the survey show that 30.40% take into account the direction of the wind when spraying and 69.60% do not know whether to take this direction into account. Figure 5 shows the timing of

pesticide application. 44.6% of producers treat early in the morning and those who treat late at night represent 32.10%. Early morning and late evening treatment are recommended times of the day. Producers who deal during the unfavorable times of the day, afternoon and anytime represent 14.30% and 8.90% respectively.

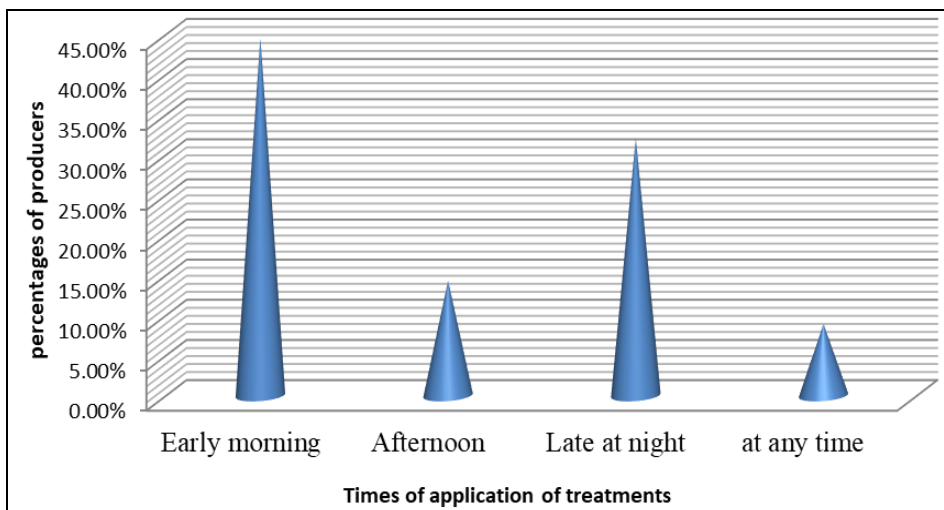


Fig 5: Distribution of producers according to the times of application of treatments

3.9 Time to return to the plot after treatment

Figure 6 shows the time taken to enter the plots after a treatment. Analysis of the figure indicates that 73.20% of

producers return to their plots less than 24 hours after treatment and 14.30% take 48 hours. This situation can put producers at risk of poisoning.

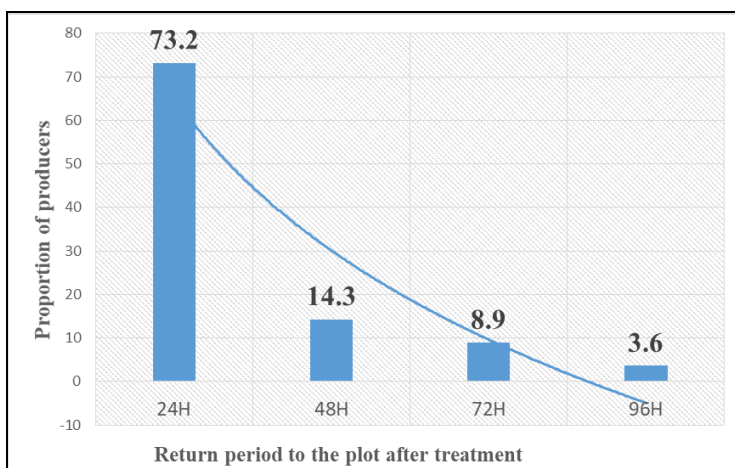


Fig 6: Proportion of producers according to the time taken to return to the plot

3.10 Management of empty packaging after use of pesticides

Figure 7 shows the fate of empty packages after treatment. An analysis of the graph shows that 70% of producers throw

away their packaging after using pesticides and 12% reuse them. Landfilling and burning of packaging represent 4 to 5% respectively.

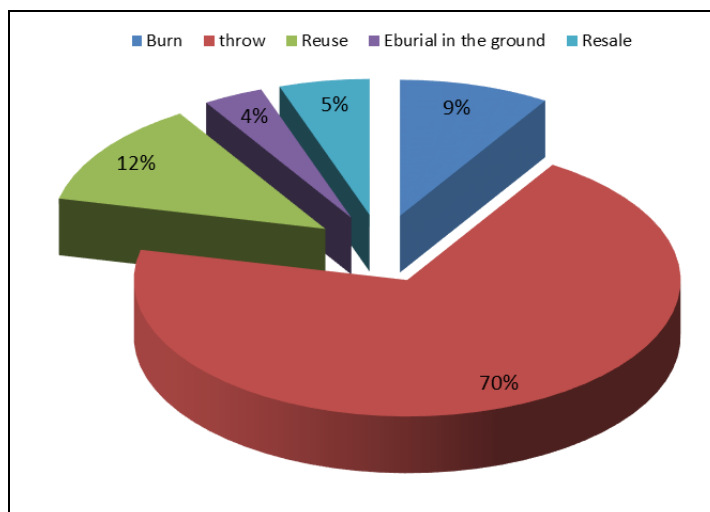


Fig 7: Distribution of producers in the management of empty packaging

3.11 Pesticide storage locations

Figure 8 indicates that 71% of producers store pesticides in

their homes and 29% store them at farm level. Pesticides are stored at plot level under shrubs or in holes.

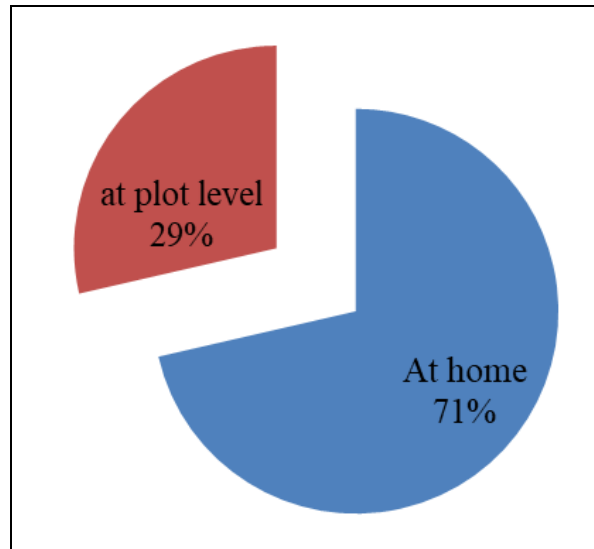


Fig 8: Distribution of producers at the Pesticide Storage Site

3.12 Perception of health risks

Producers surveyed claim to have had cases of poisoning. The analysis in Figure 9 shows that 30% of producers suffer from a cold and headaches account for 21%. The cases of poisoning which are poorly represented among producers

are vomiting, blurred vision and stomach aches which are respectively 2%, 7%, 9%. This situation is due to the fact that the application of pesticides is done without the provision of personal protective equipment or the wearing of unsuitable equipment.

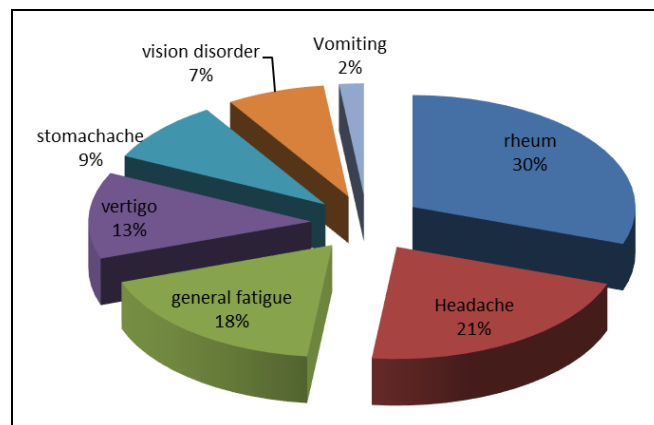


Fig 9: Proportion of producers on the risks of pesticide use

4. Discussion

The results of the survey show that phytosanitary products are applied to protect crops from pests or to fight against weeds. Thus, the analysis of the results obtained made it possible to identify 17 pesticides used by producers represented by seven (7) chemical families, of which only 11.76% are approved. These results are close to those found by Zabeirou *et al.* (2018) ^[14] in the Madaoua department where 25 trade names including 11 active ingredients, 2 belong to the WHO hazard classes. The most widely used chemical families are organophosphates 34.61%, pyrethrinoids 15.38% and avermectins 11.53%. During this study 60, 70% of the producers carried out the treatment without any means of protection and 20.60% carried out the treatment with inappropriate means of protection. The main reasons why producers do not use any means of protection are: ignorance of the risks of exposure, the high cost of protective equipment. The work of (Wade, 2003) ^[13]

reported that 90% do not use any protection. This paradox means that the farmers are aware of their exposure situation but are mostly unaware of the danger of pesticides and therefore neglect the means protection or do not have the means to obtain it. These precarious means of substitutions are far from guaranteeing safe use of pesticides, but predispose the applicator to high health risks (CNRS, 2010). Some empty packaging is thrown away by producers after use. Similar findings were made by Soro *et al.* (2019) ^[10] in Togo where 82% of producers throw away packaging. Resale, burial and burning have been observed on market gardening sites by Wade (2003) ^[13] in Senegal and Son D. *et al.* (2017) ^[9] in Cameroon. The uncontrolled use of plant protection products exposes the risk of environmental pollution (Soro *et al.*, 2019) ^[10]. Regarding the management of pesticides, it appears from the results found that 71% of producers store their pesticides in their homes and 29% at the plot level. These results are different from those found

by (Diakira *et al.*, 2017) ^[4] where 75.4% Store at their plot level and 24.59% in the house. The non-compliance with the recommended doses and the application of chemical fertilizer without taking into account the useful dose to the plant is explained by the illiteracy of producers and the lack of training in good practices. The pre-harvest deadline is not respected by the producers and more than 83.90% are not aware of the deadline. These results are not proportional to those of (Wade, 2003) ^[13] where more than 90% of the producers surveyed know that it is necessary to wait at least a long time between the last application and the harvest but they are unaware that each product has its own duration of production. deficiency. The time before harvest varies from 1 to 14 days. This is due to the lack of education of producers who cannot read the pesticide label. Failure to observe the elimination period constitutes a danger to the health of consumers. Ignorance of the waiting period leads to pesticide residues on crops and poses the risk of poisoning for consumers (Oyono, 2008) ^[7]. In order to protect the health of consumers, it is necessary to respect the doses of use and especially the time before harvest of each product, so as to avoid that the pesticide residues contained in the treated vegetables do not exceed the maximum limits (Diakilia , 2017) ^[4]. The educational status of market gardeners does not militate in favor of a rational use of pesticides, the limit of their ability to read, understand, and apply manufacturers' instructions (Diop, 2013) ^[5]. The pesticides applied by the producers come from an informal circuit. Sellers of chemical inputs are not licensed. More than 88.24% of the products are not approved. This is justified by the absence of a state circuit for the sale of pesticides in the rural commune of Tabalak. The official distribution circuits of pesticides are not mastered, hence the proliferation of the informal sector. Thus, the products are distributed and sold by unauthorized people or distributors of plant protection products who do not check the conformity of the products they sell (Ulrich, 2015). The study also found cases of poisoning among producers. The different cases are among others colds, headaches and stomach aches and dizziness. The lack of wearing protective equipment favors cases of poisoning by producers. The behavior of market gardeners reveals that they practice market gardening that does not respect the environment and the health of producers (Doumbia, 2009) ^[6]. The same observations were made by (Sawadogo, 2012) who reported that 7.7% of producers are victims of colds, 2.5% of dizziness. Pesticide users do not express themselves easily on the relationship between health problems and the use of pesticides (Soulé *et al* 2015) ^[11]. The bad ones practice in particular the lack of protective equipment and the ignorance about the dangerousness of the products favor the cases of poisoning among the peasants. Failure to meet the deadlines for entering the gardens favors intoxication of producers.

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