Journal of Fisheries & Livestock Production
ISSN: 2332-2608

Research Article Open Access

Assessment on Utilization of Pesticides and Their Effect on Beekeeping in Kafa and Benchi-Sheko Zones, Southern Nation Nationalities and Peoples Region (Snnpr), Ethiopia

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Abstract

The study was conducted in Kafa and Benchi-Sheko zones with to identify types of pesticides, their utilization, and their impacts on the beekeeping industry. Purposive sampling was used for study sites selection. Accordingly, a total of four districts being Debub Benchi and Guraferda from Benchi Sheko Zone; Chena and Gimbo districts from Kafa zone were selected. Three peasant associations (PAs) were purposively selected from each district based on their pesticide utilization and agro-ecologies. Available data were collected from beekeepers, non-beekeepers, key informants, and field observations. From the study, a total of 12-types of pesticides being Roundup, 2,4-D, Malathion, Diazinon, Ridomill, Mancozeb, Profit, Agrolambasin, Matico, Sevin, Imidacloprid, and Karatine were found to be used in the areas for controlling various pests and diseases from crops and animals. Of which 2, 4-D and Roundup were widely used for controlling various weeds. Most (68.9%) respondents use pesticides with a significantly higher number (73.9%) of non-beekeepers using pesticides than beekeepers (63.9%) at $p<0.05$. Illegal traders, legal traders, and Governmental Organizations were the major sources of pesticides sharing 53%, 30%, and 17% respectively. Utilization of pesticides was higher in low lands compared to midland and low land areas. However, there was no significant variation in the utilization of pesticides between beekeepers and non-beekeepers at $p<0.05$. Moreover, though most farmers were found to have knowhow about the side effects of pesticides on the environment and other non-targeted species, the overall cares taken before, during, and after the application of pesticides was very less.

Keywords: Pesticides; Utilization; Agro ecology; South-western Ethiopia

Introduction

Pesticides play crucial roles in improving the livelihoods of the world population through reducing hunger due to pre- and post-harvest losses of agricultural products by pests and pathogens as well as in controlling various vectors and healthcare problems of human beings (FAO, 2014). The amount and types of pesticide being imported is incredibly increasing from time to time in relation with a high rising rate of the world population. For instance, by the coming thirty years (i.e.in1950) studies indicated that the world population size will be expected to rise by over 30% of the current number (7billion); requiring about 50% more food/feed than sources than the current amount. So, to compensate for this, using agricultural inputs like fertilizer, improved seeds and pesticides are prerequisites to maximize the production levels from the restricted plots of lands (FAO, 2018). Nowadays, various public and private enterprises are engaged in the importation and manufacturing of various pesticides. However, the widely use of pesticides also result in great controversies between beekeepers and crop growers. The effect of chemicals might also be highly in touch with human lives through direct or indirect ways. The type and extent of pesticides' utilization vary from place to places due to so many reasons. Conducting a comprehensive study on the existing situations on utilization of agricultural inputs is crucial to facilitate conditions for sustainable environments to have minimal adverse effects on its creatures. Hence, the current study was aimed at identifying the types of agrochemicals pesticides being commonly applied in the areas, their utilization status and their adverse economic impacts on the beekeeping subsector.

Materials and Methods

Description of the study areas

The study was conducted in Kaffa and Benchi-Sheko Zones. Chena and Gimbo districts from Kaffa Zone, and Semein-Benchi and Gurra ferda districts from Benchi-Sheko Zone were purposively selected for the study (Figure 1). Study districts were known for their intensive use of pesticides due to the widely grown crops like 'Eragrotic teff,' fruits and vegetables, chat (Chat adulis') and commercial crops plantations (tea and coffee). The area is known for receiving an ample amount of rain fall throughout most of the seasons of the years from March to the end of November. Annually, it may receive 1000 - 2200mm rainfalls, and the minimum and a maximum daily temperature range from 10-28 °C [1]. The altitudinal gradient of the area ranges from below 500 to over 3340 meters above sea levels [2]. The high rainfall amount the area receives creates opportunities for the fast growth of herbs/weeds which are the main challenges for crop growers for timely controlling using manual weeding. Enset, coffee, and various root crops like 'godere' are the major livelihood crops for most communities of the areas. About the high coverage of natural forests, the area is also one of the most potent known parts of the country for beekeeping practices.

Methodologies

Selection of Study sites and respondents

Study districts were purposively selected based on their history

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Received: 13-Jan-2022, Manuscript No: jflp-22-51664; **Editor assigned:** 18-Jan-2022, Pre QC No. jflp-22-51664 (PQ); **Reviewed:** 01-Feb-2022, QC No. jflp-22-51664; **Revised:** 04-Feb-2022, Manuscript No. jflp-22-51664 (R); **Published:** 11-Feb-2022, DOI: 10.4172/ 2332-2608.1000328

Citation: Shegaw T, Habtegiorgis D, Edimew T (2022) Assessment on Utilization of Pesticides and Their Effect on Beekeeping in Kafa and Benchi-Sheko Zones, Southern Nation Nationalities and Peoples Region (Snnpr), Ethiopia. J Fisheries Livest Prod 10: 328.

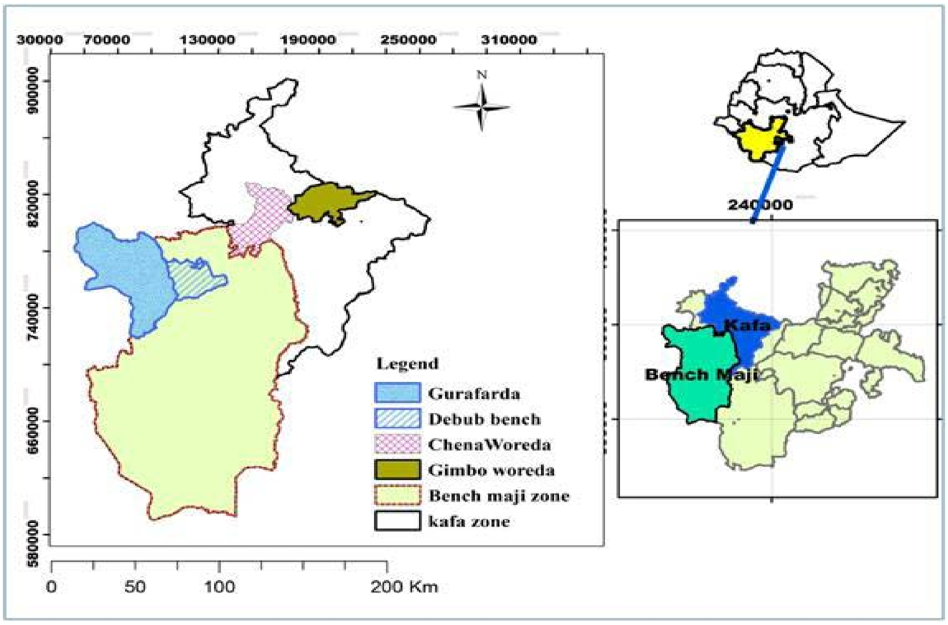


Figure 1: Map of study areas.

of pesticide utilization. From each district; three peasant associations (PAs) were purposively selected based on their agro-ecological variations and from each study site (PAs) 30 individual farmers being 15 from beekeepers and 15 from non-beekeepers were randomly selected. Hence, a total of 90 individuals from each district and a total of 360 individuals (180 beekeepers and 180 non- beekeepers) were selected. Both qualitative and quantitative survey data were collected using a pre-tested and redesigned questionnaire. In addition, Key informant interviewing (KII)was undertaken with individuals or organizations who are directly or indirectly taking part in the marketing and supply of pesticides.

Result and Discussion

Demographic Characteristics of the respondents

Of the total respondents, the majorities, 354(98.3%) were male and 6(1.7%) females. About age groups, 133(36.94%), 126(35%), 94(26.11%), and 7(1.94%) were found to be within 25-45, 46-55, >55, and <25 years of ages respectively. According to the educational level lists, the majority being 122(33.89%) of the respondents attended grades 1-4. Whereas, 83(23.06%), 68(18.89%), 55(15.28), 29(8.06%), and 3(0.83) of them have education levels of reading and writing, Grade 5-8, Illiterates, Grade 9-12 and above grade 12 respectively (Table 1). The current result coincides with the report of Tesfu et al. [3] that around 85% of the farmer communities in the areas were found attended up to Grade 4 education levels.

Individuals using pesticide

The predominant number, 248(68.9%) of individuals were found using agrochemicals for preventing their crops from various pests and diseases; and 122(31.1%) of them were do not use any pesticides. The number of individuals using pesticides was significantly lower than that of the result in the Ejere District of West Shoa which was over 99% of the farmers in the areas were using pesticides (Solomon et al., 2018). Of the total interviewed beekeepers 115 (63.9%) were using pesticides. Whereas, of the total interviewed non-beekeepers, 133 (73.9%) of them were found using pesticides (Figure 2). Significantly fewer numbers of beekeepers were found to use pesticides compared to non-beekeepers at p<0.05 (Figure 1).

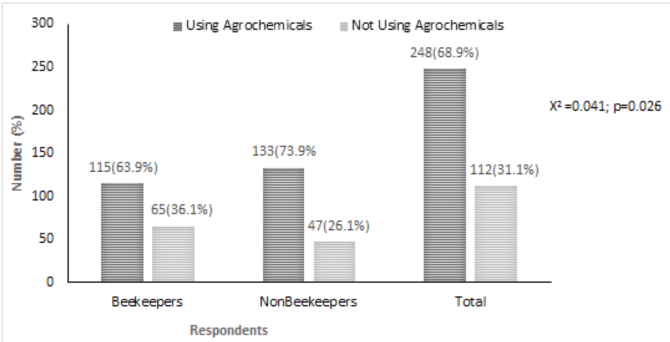


Figure 2: Number of individuals using Agrochemicals.

SN	Variables	Category	Frequency	Percent
1	Sex	Male	354	98.3
		Female	6	1.7
2	Age	<25	7	1.94
		25-45	133	36.94
		46-55	126	35
		>55	94	26.11
3	Educational level	Illiterate	55	15.28
		Read and write	83	23.06
		Grade 1-4	122	33.89
		Grade 5-8	68	18.89
		Grade 9-12	29	8.06
		Above Grade 12	3	0.83
4	Marital Status	Married	313	87
		Divorced	14	4
		Widowed	11	3
		Unmarried	22	6

Table 1: Demographic Characteristics of respondents.

Purposes of pesticides

The term Pesticide is the general name for chemicals or other products used in killing, repelling, or controlling pests [4] which are widely used in agriculture encompassing herbicides, insecticides, fungicides, rodenticides, molluscicides, nematicides, plant growth regulators and others [5].

Based on the context of using pesticides for honeybees or not, sometimes pesticides could be grouped into two broad categories being the intentional ones (those applied in hives to suppress various bee pests like varroa, wax moth, brood diseases) and unintentional ones (those applied on fields for crops) [4]. Both have adverse effects either on bees and their products in such a way that the intentional types of pesticides have considerable impacts on bees' products being the honey and beeswax due to their residual effects and the unintentional ones are mostly known for directly affecting honeybees themselves. Perhaps, the issue of maintaining organic products by one or any means doesn't allow any use of chemicals.

According to the survey results, majorities of respondents accounting for 52.93% were using pesticides to control weeds (herbicides), 26.90% for insects, and 20.17% for fungi (Figure 3). Similarly, Beyene et al. [6] also reported that pesticides are widely imported in the country for the control of herbs, insects, fungi, and other purposes sharing 63%, 28%,8% and 1% respectively.

Types of pesticides and their uses

Of the total 248 respondents using pesticides, the predominant were using 2, 4-D, and Round up accounting for 41% and 22% respectively. A considerable number of individuals use Malathion, Diazinon, Agrolambasin, Mancozeb, Karate, Redomil, Matico, Imidacloprid, Triclazole-75%(Profit) and Sevin(youcan) sharing 13%, 9.3%, 2.7%, 2.7%, 2%, 1.8%, 1.8%, 1.8%, 1.6% and 1.4% respectively (Table 3). Farmers use 2,4-D for controlling broad-leaved weeds in various cereal crops. Roundup is a non-selective type of pesticides widely sprayed in

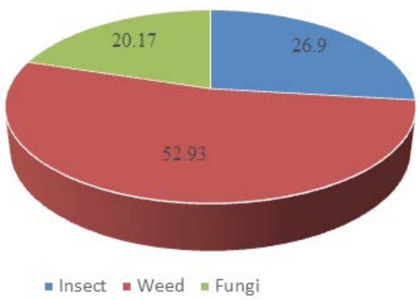


Figure 3: Purposes of pesticides.

areas with intense grasses grown to eradicate grasses and other weeds mainly in preparation of lands for crop cultivation and also sprayed under coffee and tea plantations. Diazinon is one of the widely used pesticide for controlling pests like ball worms occurring on cereals, Enset ventricosum, and Catha edulis crops. Malathion is another widely used type of pesticide in the prevention and controlling of pests both pre- and post-harvesting stages such as from weevils, termites, worms and ants. Pesticides like Mancozeb, Agrolambasin, Karatine, Redomill, Matco, Imidacloprid, Profit, and Sevin are used by some individuals for controlling various fungal disease outbreaks mainly on fruit and vegetable crops like green pepper, cabbages, tomatoes, and so on (Table 2 and 3).

According to FAO, 2018, about high population size increments, by the coming thirty years (in 2050th) the Global food/feed demand will be expected to rise by 50% of the current demands. So, to overcome this, the application of pesticides and other agrochemicals is unquestionable [7 and 8]. However, as much as possible its application should be in favor of minimizing the risk on non-targeted species. According to Malcolm [9], honeybees are expected to contribute for about 85% of world's pollination services. However, due to their distinctive foraging behaviors, they are one of the most susceptible species for various pesticides applied in fields [10]. Hence, safeguarding the lives of honeybees should be everyone's concern to boost their product yields while increasing the worth from their indirect benefits which is through pollination services. This could be achieved by following a comprehensive integrated pest management (IPM) approach. In this concern, almost none of the respondents have knowhow about IPM concepts. Similarly, a study by Beyene et al [6] also indicated the concept of IPM is almost nonexistent throughout most parts of the country except in a few horticulture production areas.

According to comparison on utilization level of pesticides across agro-ecologies indicated that there is no significant variation in several individuals using herbicides being 2, 4-D and Roundup. However, respondents in the low land areas utilize a significantly higher amount of 2,4-D than high land and midland areas (at $p<0.05$). This could be due to the variation in types of crops widely cultivated across agro-ecologies. Accordingly, 'teff' and rice were widely grown in low land areas compared to mid and high land areas. Similarly, various fruit and vegetable crops are widely grown in low land areas compared to high land and midland areas. As a result, pesticides like Malathion, Diazinon, Ridomill, Mancozeb, and profit, Agrolambasin, Matico, Sevin, Imidacloprid and Karatine are widely sprayed in low land areas in controlling of outbreaks of various fungal diseases. Due to this, the overall consumption level of most pesticides gets higher in

SN	Pesticides	N (%)	Mean±SD	Crops	Used for controlling
1	2,4- D	229(40.7)	0.68±0.38	Cereals (teff, rice, wheat, barley)	Broad-leaved weeds
2	Roundup	122(21.7)	0.99±0.85	Coffee, tea and for land preparation (for cereals)	Any types of weeds
4	Malathion	73(13)	0.58±0.38	Maize, teff, green pepper, chat	weevil, termite, insects, worms, animal parasites and ants
3	Diazinon	52(9.3)	0.33±0.20	Maize, *teff* and *enset*	Worms, insects
5	Agrolambasin	15(2.7)	1.10±0.39	Fruits and vegetables	Fungi diseases
6	Mancozeb	15(2.7)	1.03±0.23	Fruits and vegetables, chat	Fungi diseases
7	Karatine (lambda cyhalothrin)	12(2.1)	0.65±0.43	Fruits and vegetables, chat	Fungi diseases
8	Redomill	10(1.8)	0.917±0.18	Fruits and vegetables	Fungi diseases
9	Matico	10(1.8)	1.200±0.483	Fruits and vegetables	Fungi diseases
10	Total (Imidacloprid)	9(1.6)	0.778±0.363	Fruits and vegetables	Fungi diseases
11	Profit	8(1.4)	1.045±0.317	Fruits and vegetables	Fungi diseases
12	Youcan (sevin)	7(1.2)	0.714±0.267	Fruits and vegetables	Fungi diseases

Table 2: Types of pesticides and their uses.

AEZ	Parameters	Roundup	2,4-D	Malathion	Diazinon	Ridomil	Mancozeb	Profit	Agrolambasin	Matico	Sevin	Imidacloprid	Karatine
HL	Mean	0.82	0.56^{b}	0.38^{b}	0.29^{ab}	-	1.00	-	1.25	0.75	-	-	-
	N	31	67	15	14	-	2	-	2	2	-	-	-
	SD	0.43	0.36	0.23	0.18	-	0	-	0.35	0.35	-	-	-
ML	Mean	1.10	0.64^{b}	0.54^{b}	0.25^{b}	1.00	1.17	-	1.50	-	-	0.75	0.63
	N	55	78	26	16	1	3	-	2	-	-	2	2
	SD	1.15	0.46	0.34	0.08	-	0.29	-	0.71	-	-	0.35	0.53
LL	Mean	0.99	0.81^{a}	0.70^{a}	0.42^{a}	0.91	1.00	1.04	1.01	1.31	0.71	0.79	0.65
	N	36	84	32	22	9	10	8	11	8	7	7	10
	SD	0.50	0.38	0.43	0.25	0.19	0.24	0.317	0.32	0.46	0.27	0.39	0.44

NB: HL-highland; ML-mid land;LL-low land; N; number of individuals; SD; Standard Deviation; different letters of superscripts indicate the variation of meanvalues at p<0.05.

Table 3: Pesticides utilization by agro-ecologies.

Respondents	Parameters	Roundup	2,4-D	Malathion	Diazinon	Ridomil	Mancozeb	Profit	Agrolambasin	Matico	Sevin	Imidacloprid	Karatine
Beekeepers	Mean	0.97	0.65	0.55	0.25	0.83	1.00	0.97	1.11	1.20	0.63	0.60	0.50
	N	58	103	31	23	5	6	5	9	5	4	5	7
	SD	0.46	0.41	0.37	0.16	0.24	0.00	0.34	0.42	0.45	0.25	0.22	0.35
Non-Beekeepers	Mean	1.02	0.7	0.60	0.39	1.00	1.06	1.17	1.08	1.20	0.83	1.00	0.85
	N	64	126	42	29	5	9	3	6	5	3	4	5
	SD	1.09	0.36	0.40	0.22	0.00	0.30	0.29	0.38	0.57	0.29	0.41	0.49
Total	Mean	0.99	0.68	0.58	0.33	0.92	1.03	1.04	1.10	1.20	0.71	0.78	0.65
	N	122	229	73	52	10	15	8	15	10	7	9	12
	SD	0.85	0.38	0.38	0.20	0.18	0.23	0.32	0.39	0.48	0.27	0.36	0.43

NB: N-Number of individuals; SD- Standard Deviation of values

Table 4: Pesticides Utilization by type of respondents.

No	Common Name	Active ingredient	Purposes	Rate	Volume used per hectare
1.	Mancozeb	Dithane M-45	Fungicide	0.0025	1000L
2.	2,4-D	2,4-Dichlorophenoxyacetic acid	*Herbicide*	*0.004*	*240L*
3.	Roundup	Glyphosate-360; Isopropyl amine salt of Glyphosate-480g	Herbicide	0.004	480L
4.	Matco	Metalaxyl 0.08 +Mancozeb 0.64	Fungicide	0.0025	1000L
5.	Rodmill	Mefenoxam-4%, Mancozeb-64%	Fungicide	0.0025	1000L
6.	Agrolambasin	Profenofos-30%EC	Insecticide	0.004	1000L
7.	Lambda- cyhalothrin	Karate-5%EC	Insecticide	0.32	1000L
8.	Total (Imidacloprid)	Imidacloprid 2.5%, Cyfluthrin 2.5 EC	Insecticides	0.004	1000L
9.	Youcan (Sevin)	Carbaryl (1-naphthyl methylcarbamate)	Insecticides	0.004	1000L
10.	Profit	Tricyclazole-75%	fungicides	0.004	1000L
11.	Diazinon	Diazion 60% EC	Insecticide	0.011	917L
12.	Malathion	Malathion 50%	insecticide	0.01	1000L

Table 5: Recommended concentrations (rates) of pesticides.

low land areas than midland and high land areas (Table 3). Similarly, reports by Nonga et al. [11] also indicated that the type and intensity of pesticides application does significantly vary based on the types of crops grown. Irrigable areas known for intense fruit and vegetable cultivation are more likely to use pesticides being insecticides and fungicides. However, the pesticide utilization level of individuals does not vary based on the types of respondents being beekeepers versus non-beekeepers at p<0.05 (Table 4). Even though the amount is not clear some beekeepers were also using flits to drive ants (bees' pests) in time of approaching their hive for attacking colonies.

According to table 5 each pesticide has its own recommended concentration level to be prepared during application. However, most individuals use other individuals/sprayers/ who own the knapsacks by rent. As those individuals spraying throughout full day times, adjusting the times of spraying in favor of bees' activity is almost non-existent. Some individuals also increasing the rates of pesticides whenever they consider it eradicating pests/weeds/ effectively. However, this could have an impact on soil and its related biotic creatures; even the degree of devastation on honeybees also intense. Few also practice mixing of different types of pesticides used for similar purposes in order for the a fore mentioned purposes.

Utilization trends of pesticides

In recent years the importation and utilization of agrochemicals have grown rapidly due to an increasing trend of agricultural intensification which is considered as one of the main developmental plans and expansion of horticulture [6-7, 12]. However, their application is still commonly done at the expense of the environment and non-targeted organisms including human beings [13]. As depicted in figure 4, the overall trends of pesticides utilization of respondents for the last five fiscal years (from 2015 to 2019) were found to be steadily increasing with a slope of 0.104. Despite an increasing level of agricultural intensifications, the increasing rates of pesticides utilization might be related to an increasing number of individuals who were taking part in the cultivation of tea crops at individual small-scale levels. Similarly, Taye and Mekonen [14] also reported that an ever-growing use of various pesticides which mostly are indiscriminately applied was one of the major causes for intense colony mobility in the country particularly in highly horticulture growing areas.

Sources of pesticides

In the areas, illegal traders who are selling pesticides in open markets and shops with other commodities are the major sources where pesticides are readily available. Legal traders were also found to be the second actors being sources for pesticides. However, in addition to some local traders found in the areas, some respondents would also be purchasing pesticides from legal traders from Addis Ababa. Governmental Organizations (GOs) like Wushwush tea plantations (found in the near distance from Bonga town) and the Bureau of Agricultures are also sourced in the provision of some pesticides like Roundup, 2,4D, Diazinon and Malathion (Figure 5). Similarly, Nonga et al. [11] reported that in most developing countries, pesticides are less accessible for users; where illegal traders are the major sources for. This in lining with other factors like limited knowhows about its impacts on environment, lack of extension services and integrated pest management options (IPM) are considered to be the main causes for their unwise applications.

Reasons for not using pesticides

According to survey results, 112 (31.1%) individuals were not using pesticides for saving their bees, owning few/no croplands, using man powers, save qualities of their crop products, lack of incomes, considering it will reduce soil fertility and reduces crop yield sharing 25.71%, 14.29%, 14.29%, 13.71%, 10.29%, 8.00%,7.43% and 6.29 respectively (Table 6). Similarly, Wasim et al. [5] also indicated that various pesticides sprayed in control of various crop pests and diseases have adversely affected the soil microorganisms which are very essentials for the conversion of atmospheric nitrogen and other nitrogen compounds into nitrates accessible for plants. Significantly higher number of beekeepers replied that they would not spray pesticides in favor of honeybees' health compared to non-beekeepers ($p<0.001$) (Table 6). This revealed awareness on honeybees' contribution for the social economy through their valuable pollination service is very low considering they are useful for beekeepers only. Similarly, upon survey results of farmers requested to list roles of honeybees, over 95% of them did not reply that honeybees have a role for pollination services. Few individuals, even if they don't have reasons for not using pesticides

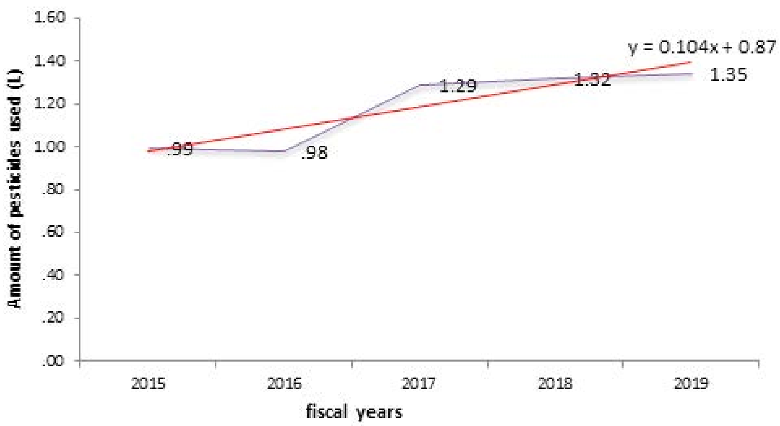
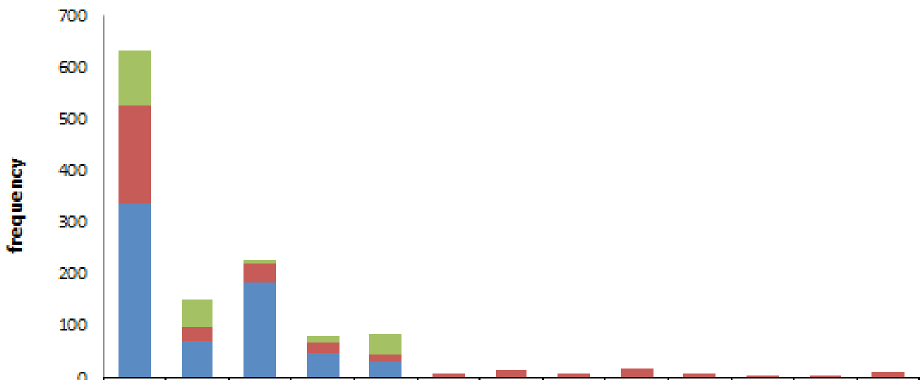


Figure 4: Utilization trends of pesticides.



	Over all	Roun d up	2,4-D	malat hion	Diazi non	Rido mil	Manc ozeb	Profit	Agrol amba sin	Matic o	sevin	Imida clopri d	Karat e
Gos	108	53	5	12	38	0	0	0	0	0	0	0	0
legal traders	188	27	37	21	15	10	15	8	18	10	7	7	13
illegal traders	338	72	185	49	32	0	0	0	0	0	0	0	0

Figure 5: Sources of pesticides.

SN	Reasons	Beekeepers	(%)	Non-beekeepers	(%)	X^2	Total	(%)
1	Affects bees	45	40.54	0	0	0.00	45	25.71
2	Few/No croplands	11	9.91	14	21.88	0.11	25	14.29
3	Using manpower	15	13.51	10	15.63	0.82	25	14.29
4	Affects the quality of crops	13	11.71	11	17.19	0.67	24	13.71
5	Lack of income	7	6.31	11	17.19	0.07	18	10.29
6	Unavailable	6	5.41	8	12.5	0.06	14	8.00
7	Reduces soil fertility	7	6.31	6	9.38	0.75	13	7.43
8	Reduces crop yield	7	6.31	4	6.25	0.69	11	6.29
	Total	**111**	100	**64**	100		175	100

Table 6: Reasons for not using Agrochemicals.

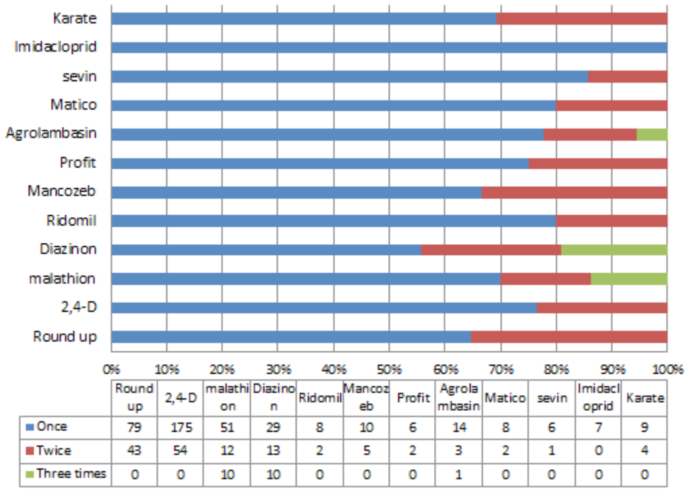


Figure 6: Frequency of application.

on other crops, they have got advice from agricultural bureaus and other stakeholders not to use pesticides especially 'Roundup' for coffee plantations to maintain its organic quality for international markets. In part intercropping was also observed to be one of the reasons for not using pesticides (herbicides) which the cultivation of broad-leaved crops mainly legumes with maize and sorghum is very common. So, the application of pesticides is very less in maize and sorghum growers.

Frequency of application

Majority of farmers were applying pesticides once a year in all types of pesticides. While some are also applying twice in most types pesticides and few applying even up to three times a year in some pesticides like Malathion, Diazinon and Agrolambasin (Figure 6). The variation in frequencies of application might be related to purposes, availability of the pesticides, and preference by the users in terms of its relative costs and killing ability of pests. Similarly, Nonga et al. [11] indicated that frequencies of pesticides application are highly determined by the frequency of crop harvesting. In this regard farmers in irrigable lands relatively use pesticides more frequently. According to his reports farmers may use even up to four times and more a year.

Time of application

According to Amssalu et al. [15] and Dawit et al. [16], almost all types of pesticides applied in the fields are significantly affecting bees either directly by killing the foragers or indirectly by devastating their forages which eventually will be diminished due to starvations. Adjusting the time of application, types of chemicals (regarding toxicity and persistence), various environmental conditions are the major factors to be considered in halting or minimizing the adverse effect levels of pesticides. However, these concerns are less considered especially in developing countries where awareness and know-hows are very low [17 and 18]. Regarding the time of application of pesticides majorities of the respondents replied that spraying will take place before noon almost in all pesticide types and some farmers may also spray during the afternoon and some at any time starting from 10:00 AM to late afternoon (around 4:00AM) (Figure 7). According to Hooven et al. [19], honeybees are more affected by pesticides due to immediate contact while they are foraging. Honeybees are actively engaged in foraging activities starting from early morning to mid-day times [20 and 21]. Hence, application of pesticides in the study areas is mostly coinciding with the peak foraging times of honeybees resulting for massive deaths of bees in the fields. Similarly, study by Dawit et al. [22] also indicated that even in areas where farmers have better knowhow about the roles of honeybees in pollination services, they will not bother the about timing of pesticides application which eventually being the major cause for beekeepers abandoning their beekeeping activity.

Farmers' Perception about pesticides and their utilization

Detailed know how's about effective utilization and effective disposal handlings are a prerequisite for the sustainable utilization of chemicals through minimizing their adverse effect on the environment and other non-targeted life forms. Chemicals may result in various health consequences through short and long terms stays unless wisely used. Hence, any simple negligence of its recommended prescription may result in various persistent consequences. The majorities of farmers have know-how regarding the negative impacts of pesticides on the environment and non-targeted species (Table 7). However, the problem is apparently on lack of awareness in taking care of the environment and other species. For instance, during our survey we

Figure 7: Time of Application.

Variables	Frequency	Percentage
Adverse effects of pesticides		
✓ Environment pollution	360	100
✓ Killing non-target species	292	81
Storage mechanisms of pesticides		
✓ Hanging inside the house	316	87.78
✓ Locked up in safe places	44	12.22
Handling ways of containers after using pesticides		
✓ Using for storing other goods (like water, milk and salt)	46	12.27
✓ Left at fields (at farms, thrown in bushes or rivers)	124	33.07
✓ Thrown in toilet	193	51.47
✓ Burnt/buried	12	3.20
Using protective clothes while spraying		
✓ Yes	8	2.22
✓ No	352	97.78
Training on pesticides use		
✓ Yes	132	36.67
✓ No	228	63.33
Following the labeled instructions of pesticides		
✓ Yes	63	17.50
✓ No	297	82.5
Mixing of pesticides		
➢ Yes	3	0.83
➢ No	357	99.17

Table 7: Farmers' Perception about pesticides and their utilization.

encountered a person in Chena District who has lost his 4 (four) cattle due to pesticides (round up) unwisely sprayed on grazing lands of his neighbors. Similarly, at Gimbo District, a beekeeper has lost about 10 (ten) of his colonies due to massive deaths by the miss application of pesticides in his neighbors. Various studies also stated that in the country, the highly increasing level of pesticides utilization accompanied with their misuses makes pesticides staying to be one of the major constraints for the beekeeping industry [23-25]. Farmers store pesticides hanging in houses and locking in boxes free from children and foods contacts. After finishing the chemicals, they dispose the containers by throwing them in toilets, leaving them in fields, using them for other goods and burying/burning sharing 51.47%, 33.07%, 12.27% and 3.2% respectively (Table 7). About 36.67% of the respondents have got training and advice on using of pesticides from various stake holders like tea plantation organization and the Bureau of Agriculture. However, the majority of them still do not follow the safety measures. An indication for this was that over 97% of the respondents do not use protective materials while spraying; only 17.50% of them follow the prescribed labeling and some farmers also do not care for proper handling of its containers after using chemicals. Some farmers were also found to practice mixing of different chemicals being 2, 4-D with Roundup (Table 7).

Effect of Pesticides on Honey yields

Regarding toxicity level, dosages and timing of application, pesticides result in conspicuous economic losses from the beekeeping subsector basically in less civilized communities [26]. According to the survey result, on average a beekeeper may lose about 17.89 kilograms of honey due to pesticides application resulting from dwindling, absconding or even massive deaths of colonies in some areas. Accordingly, a total of about 3,220 kilograms of honey which was estimated to be about 19.77% of the currently obtained yield of respondents being 16, 289 kilograms was expected to be lost annually.

Using current prices of kilogram honey (i.e., 4.5USD or 200ETB), about 14, 490 USD or 652,050 ETB will be lost annually only from honey yield incomes. However, the economic loss from pollination services which was not addressed in the current study might be expected to maximize the losses by far amounts. Apparently, in areas with severe colony shortages like the Northern parts of the country where colony sell is considered as one of the major income sources, the economic loss might get augmented [27].

Conclusion and Recommendation

In conclusion, various types of pesticides used in controlling various pests from crops and animals in the areas. However, herbicides were the most commonly applied for controlling weeds in crops mainly like coffee and tea plantations, cereals which has considerable adverse effects on honeybees' health. Though most respondents were aware of the negative impacts of using pesticides on the environment and other non-targeted species including honeybees, majorities especially non-beekeepers will not take any care in protecting honeybees while spraying chemicals. Moreover, the general safety measures taken before applications, while applications and after applications of the chemicals is very minimum. Majorities of farmers will obtain pesticides from illegal traders who are selling the pesticides with other goods in shops and open markets. Beekeepers were found to have fewer tendencies in using of pesticides than non-beekeepers.

Hence, based on the current study the following issues would be forwarded as a recommendation to be considered in the future:

- Strong awareness creation and technical supports should be given for the users regarding the sustainable utilization of pesticides, the economical roles of honeybees through pollination services.
- Promotion and implementation of issues of proclamation 660/2009 which entails effective and sustainable uses of agrochemicals in favor of minimizing Bees' death.
- Promotion and appreciation of integrated pest management (IPM) approach through ensuring the collaborative efforts of various stakeholders.
- Controlling of illegal traders of pesticides and ensuring farmers' access to less toxic and safe types of chemicals.
- Moreover, appreciation of organic products like coffee and honey through incentivizing the producers is very imperative.

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